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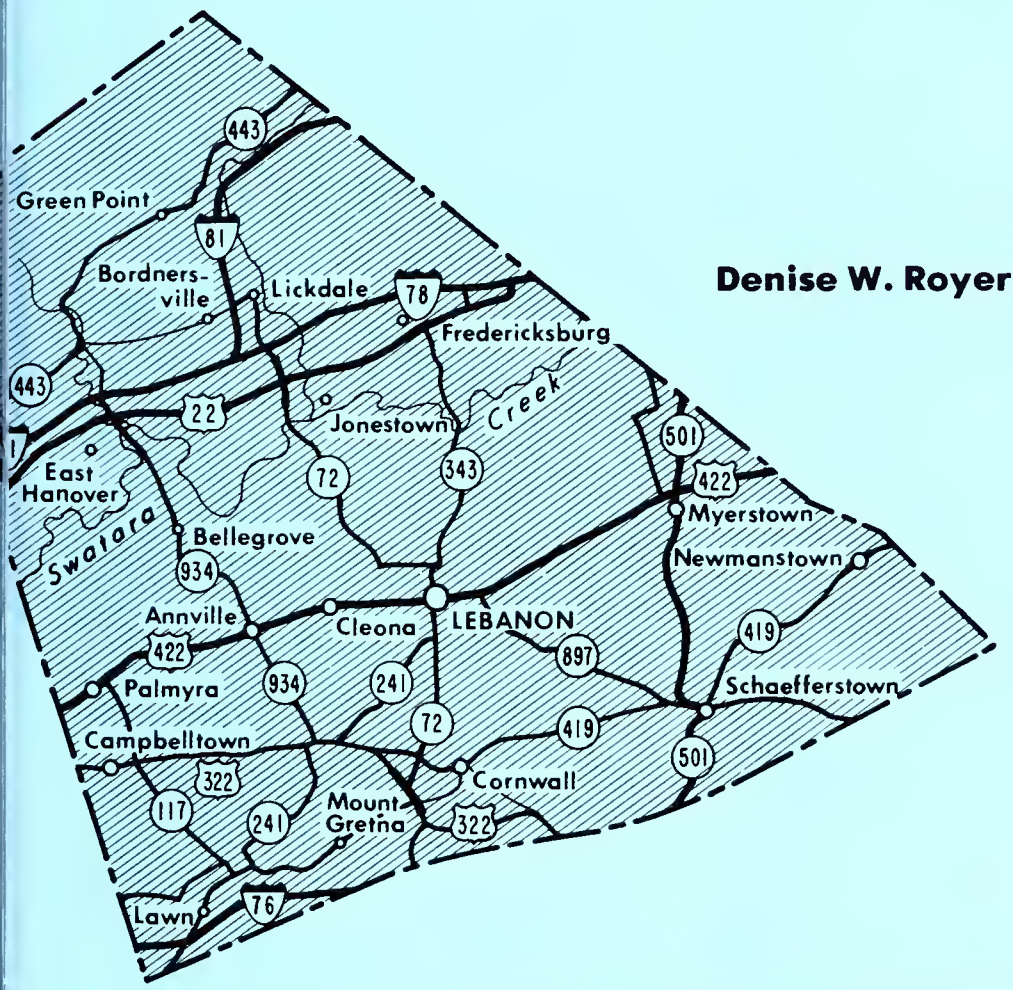
Water Resource Report 55

1983

SUMMARY GROUNDWATER RESOURCES OF LEBANON COUNTY, PENNSYLVANIA



Denise W. Royer

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
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PREFACE

This report gives a comprehensive description and inventory of the groundwater resources available in Lebanon County. With the continuing growth of our population and the expansion of our industries, there is an ever-increasing rise in demand for quality water resources. Groundwater, or subsurface water, constitutes one of the largest reserves of quality water remaining to be developed.

This report can be of assistance to anyone who is planning for future water needs. It will help to evaluate the quantity and quality of groundwater available in any part of the county, and it will aid in choosing the locations, depths, and conditions most favorable for the desired groundwater yield.

While this publication has attempted to include all significant groundwater data for the county, the Pennsylvania Topographic and Geologic Survey will continue to collect groundwater and water well data for the area; such data will be kept on file at the Survey offices in Harrisburg, available to anyone who desires the very latest information.

We hope that this report will aid users of water in Lebanon County to develop and manage their water resources so as to accommodate their water needs.

ARTHUR A. SOCOLOW

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(in envelope)

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SUMMARY GROUNDWATER RESOURCES OF LEBANON COUNTY, PENNSYLVANIA

by
Denise W. Royer

ABSTRACT

Lebanon County covers an area of 363 square miles in south-central Pennsylvania. A 1980 population of 109,829 used 34 million gallons of water per day, 70 percent from groundwater sources.

Of the 44.2 inches of average annual precipitation, 23.1 inches (52 percent) is lost to evapotranspiration. Annual stream discharge, from sources within the county, is 21.1 inches; approximately 52 percent is contributed by groundwater.

The shales and sandstones of the Swatara Creek basin, above Harpers Tavern, have an average yield of 370 (gal/min)/mi² (gallons per minute per square mile). The average yield available from the Triassic sediments in the southern part of the county is 278 (gal/min)/mi². The Lebanon Valley carbonates are capable of yielding an average of 640 (gal/min)/mi², or 87.5 Mgal/d (million gallons per day).

Adequate quantities of water are available to meet domestic and nondomestic needs. Domestic supplies of 5 to 10 gal/min are readily attainable from all rock units except diabase, the Yellow Breeches thrust plate, and the metamorphic rocks of South Mountain. Marginal yields from these units (3 gal/min or less) may require supplemental storage. Some wells in these units yield inadequate supplies (1 gal/min or less). Water supplies for nondomestic use are available from carefully selected well locations in many of the non-shaly Lebanon Valley carbonates, the Hammer Creek Formation, and some limestones in the Hamburg sequence.

Well interference is a problem in the noncarbonate rocks where high-capacity wells are spaced less than 1,500 feet apart, especially where they are in line with the strike of bedding or cleavage. In carbonate rocks, interference usually occurs where high-capacity wells are in line with solution openings.

Groundwater in the Lebanon Valley carbonates is very hard and may be high in nitrates and total dissolved solids. Wells in the Hamburg sequence yield moderately hard to hard water that is often high in iron and manganese. Groundwater from the Hammer Creek Formation is soft to moderately hard. The sandstones, shales, and metamorphic rocks in the mountainous parts of the county produce soft, acidic waters that dissolve metal plumbing.

INTRODUCTION

Groundwater is the principal water resource for most municipalities, industries, and residences in Lebanon County. Approximately 70 percent of all water used in 1980 was supplied by groundwater. This publication provides an overview of the groundwater resources of Lebanon County. Records for more than 840 wells were compiled and analyzed to complete this investigation. The report includes a general description of the aquifers and the hydrologic cycle, a geologic and well-location map, a water-level map of the carbonate valley, a summary of water well characteristics, including depth, yield, and construction, and a discussion of the chemical quality of groundwater. It is intended to be used as a reference by those who are responsible for the planning and management of water supplies, and to advise individual homeowners of water availability and its chemical quality.

ACKNOWLEDGEMENTS

The author is grateful to the many industrial concerns, public water supply companies, and private well owners for their cooperation during this investigation. Also appreciated were the groundwater data provided by the well drillers, and assistance by Jack Curry of the Department of Environmental Resources, Bureau of Community Environmental Control, in locating public water supply facilities.

The author thanks the staff members of the Pennsylvania Geological Survey and U.S. Geological Survey for suggestions, assistance in collecting water-level measurements, and project review. Special thanks are extended to Alan Geyer, Larry Taylor, Thomas McElroy, Thomas Berg, and David MacLachlan of the Pennsylvania Geological Survey, and James Gerhart and Charles Wood of the U.S. Geological Survey.

WATER USE

In 1980, about 34 Mgal/d (million gallons per day) was withdrawn from both groundwater and surface-water sources, 70 percent of which was supplied by groundwater. This total excludes the amount used for irrigation, which is negligible. Of the 23.9 Mgal/d of groundwater used in 1980, mineral and manufacturing industries withdrew approximately 16.8 Mgal/d, domestic supplies withdrew about 6.2 Mgal/d, and 0.9 Mgal/d was withdrawn for livestock. The largest industrial users of groundwater in Lebanon County are the Aluminum Company of America (ALCOA) and the Bethlehem Steel Corporation. Calcite Quarry, Inc., pumps 9.4 Mgal/d of groundwater to waste to dewater the workings.

An inventory of municipal water facilities is given in Table 1. All public suppliers except the City of Lebanon are primarily, if not solely, supplied by

Table 1. *Public Water Systems in Lebanon County, 1980*

Name	Area served	Source of water	Stream name or well or spring number	Amount of water used, 1980: Average daily use (gallons per day) including purchased water	Amount of water used, 1980: Total (million gallons)	Estimated population served, 1980[1]		Individual use[1] (gallons per day)	
Annville Township Water Authority	Annville Township South Annville Township North Annville Township	3 springs	Sp-18 Sp-61 Sp-62	494,500	181	DOM COM IND INST	1,022 mt/9 u 52 mt/2 u 8 mt 41 mt/1 u	DOM COM IND INST	144,000 mt 14,000 mt 9,000 mt 59,000 mt
Campbelltown Water Company	Campbelltown	7 springs 2 wells	Lb-798 Lb-799	59,178	21.6	DOM COM	350 mt 13 mt	—	
Cornwall Municipal Water Authority	Cornwall Borough	2 spring fields 1 well Surface water	White Quarry Springs Cold Springs Lb-432 (standby) Saddlers Run	—	[3]95.6	DOM[2] COM[2] IND[2]	595 mt 5 mt 6 mt	—	
Fredericksburg Water Authority	Fredericksburg	3 wells	Lb-442 Lb-443 Lb-444	90,310	33	DOM COM IND INST	212 mt 6 mt 2 mt 1 mt	DOM COM IND INST	25,496 mt 2,444 mt 61,448 mt 922 mt
Hill Crest View Cooperative Water System	Hill Crest View housing development	2 wells	Lb-509 Lb-510	5,000	1.8	DOM	32 mt	DOM	5,000 mt
HTMA Water System	Schaefferstown Borough	4 wells	Lb-341 (standby) Lb-342 (standby) Lb-412 Lb-788	102,521	37.4	DOM COM IND	343 mt 24 mt 4 mt	DOM COM IND	57,218 mt 10,010 mt 1,070 mt
Keystone Water Company	Annville Township Palmyra Borough North Annville Township North Londonderry Township Derry Township-Dauphin County	1 spring field	Londonderry Springs	986,700	360.1	DOM COM IND INST	3,068 mt 549 mt 19 mt 15 mt	DOM COM IND INST	398,470 mt 212,830 mt 105,680 mt 19,530 mt

Table 1. *(Continued)*

Name	Area served	Source of water	Stream name or well or spring number	Amount of water used, 1980: Average daily use (gallons per day) including purchased water	Amount of water used, 1980: Total (million gallons)	Estimated population served, 1980[1]		Individual use (gallons per day)	
City of Lebanon Water Authority	Cleona Borough Jonestown Borough Lebanon Borough Annville Township North Cornwall Township North Lebanon Township South Lebanon Township Swatara Township West Lebanon Township Union Township	Surface water	Swatara Creek Gold Mine Creek Fishing Creek	6,930,000	2,535.3	DOM COM IND OTH	11,654 mt 858 mt 117 mt 154	DOM COM IND OTH	1,975,589 mt 1,540,383 mt 723,827 mt 347,063
Mt. Gretna Camp Meeting Association	Mt. Gretna Camp Meeting	2 wells	Lb-433 Lb-794	26,764	9.8	DOM INST	236 u 4 u	DOM INST	26,764 u 460 u
Mt. Gretna Heights Water Company	Mt. Gretna Heights West Cornwall Township	2 wells	Lb-434 Lb-793	—	—		—		—
Myerstown Water Authority	Myerstown Borough Jackson Township	4 wells	Lb-703 Lb-704 Lb-705 Lb-1077	556,501	203.1	DOM COM IND INST	1,332 mt 70 mt 13 mt 20 mt	DOM COM IND INST	229,800 mt 10,600 mt 103,900 mt 33,000 mt
Newmanstown Water Authority	Newmanstown	1 spring 1 well Surface water	Gold Stream Lb-699 Unnamed tributary to Mill Creek	155,000	—	DOM COM	395 mt 20 mt		—
Pennsylvania Chautauqua Utility Commission	Mt. Gretna Borough Eastern Enterprise (in West Cornwall Township)	3 wells	Lb-795 Lb-796 Lb-797	83,067	30.3	DOM	205 u	DOM	81,923 u
Quentin Water Company	Quentin Borough	3 wells	Lb-435 Lb-1055 Lb-436 (standby)	28,339	10.1	DOM COM IND INST	159 mt/2 u 9 mt/1 u 1 mt —	DOM COM IND INST	24,565 mt/280 u 2,736 mt 176 mt 552

Richland Waterworks	Richland Borough Millcreek Township	1 spring 4 wells	Lb-700 Lb-701 Lb-702 Lb-1025	94,160	34.3	DOM COM IND	504 mt 20 mt 9 mt	DOM COM IND	71,322 mt 5,086 mt 6,322 mt
Stoney Crest Estates	Stoney Crest Estates	2 wells	Lb-1102 Lb-1103	3,240	1.2	DOM	23 mt	DOM	3,240 mt
West Lebanon Water Company	West Lebanon Township	2 wells	Lb-1104 Lb-1105	50,000	25	DOM COM INST	302 mt 5 mt 4 u	DOM COM INST	40,000 mt 8,000 mt 500 u
Leon Zimmerman Water Company	Farview Acres	3 wells	Lb-1108 Lb-1109 Lb-1110	25,201	9.2	DOM	168 mt	DOM	25,201 mt

[1] COM, commercial; DOM, domestic; IND, industrial; INST, institutional; OTH, other; mt, metered; u, unmetered.
[2] 1979 figure.

groundwater. In order to meet future water needs, the State Water Plan (Pennsylvania Department of Environmental Resources, 1980) suggests a program of residential conservation and additional well development.

HYDROLOGIC SYSTEM

Water enters Lebanon County as precipitation and streamflow, and leaves as water vapor (evapotranspiration), overland runoff, and baseflow (groundwater discharge). A small amount is retained in surface-water bodies (reservoirs, lakes, and ponds). Part of the precipitation is absorbed by the soil and either evaporates, is transpired by plants, or percolates down and recharges the groundwater zone. Groundwater moves very slowly, but eventually returns to the land surface and either discharges to springs or seeps into stream channels. The majority of the county's waterways—Swatara, Conewago, Hammer, and Stony Creeks—drain into the Susquehanna River. Tulpehocken Creek is a headwater tributary of the Schuylkill River.

In Lebanon County, 24 percent of the average annual rainfall recharges the groundwater zone. The average annual recharge (or infiltration) is an approximate estimate of the maximum amount of water available for consumptive use. This amounts to about 513,000 (gal/d)/mi^2 (gallons per day per square mile). Withdrawals in excess of this amount would severely reduce baseflow to streams and progressively lower groundwater levels.

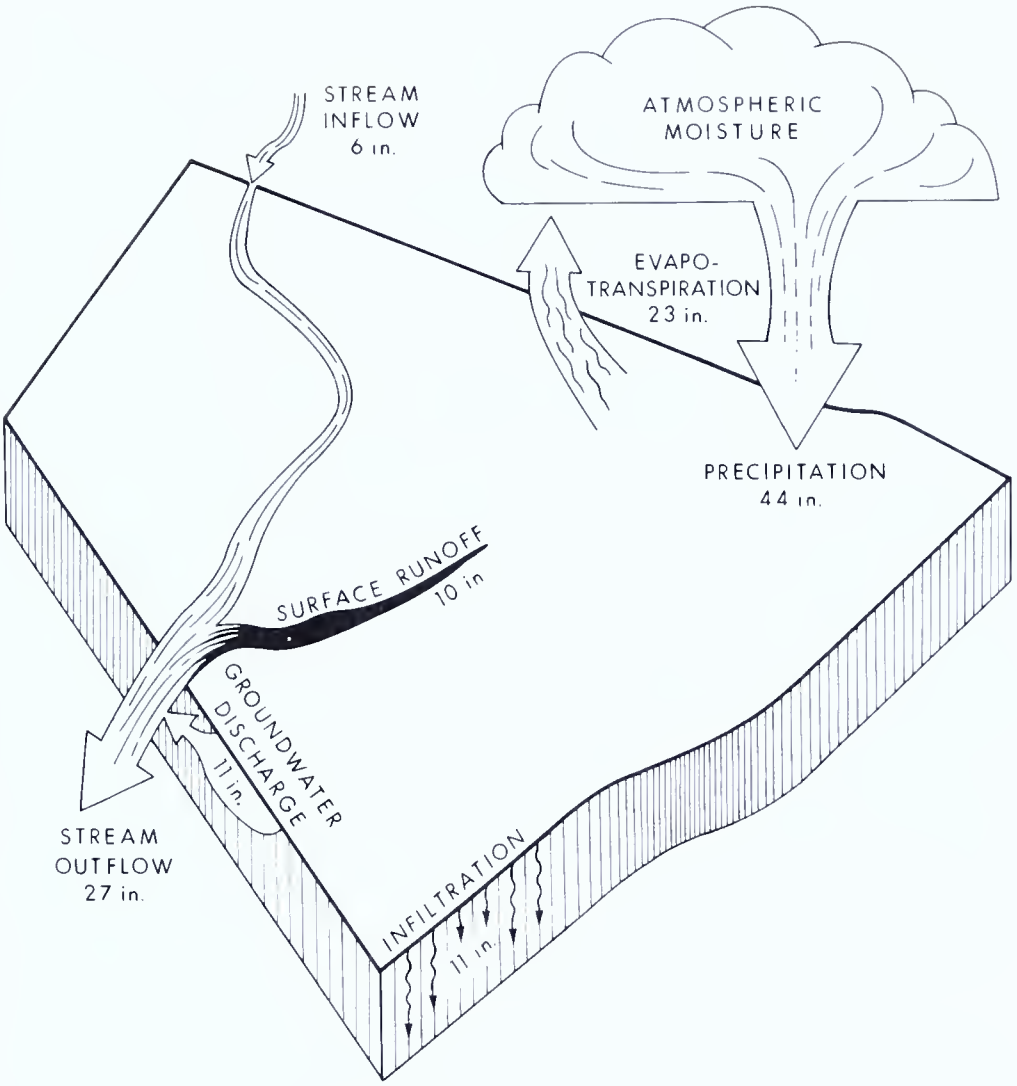
Figure 1 illustrates the hydrologic cycle for Lebanon County. The reader should note that the numbers used for the various hydrologic components are approximate annual averages and should not be used directly for management purposes.

PRECIPITATION

The average annual precipitation recorded in Lebanon for the years 1883 to 1961 is 44.2 inches per year. As seen in Figure 2, precipitation varies from month to month, but is more or less evenly distributed throughout the year. The highest monthly average is reported for July (4.53 inches) and the lowest for February (2.52 inches). The average annual precipitation for the Blue Mountain area and north is about 49 inches (Stuart and others, 1967). This increased precipitation is due to the forced ascent of air over the higher mountains of the Valley and Ridge physiographic province. Similar orographic effects also occur in the South Mountain area.

EVAPOTRANSPIRATION

A large part of the precipitation that falls in the county is returned to the atmosphere as water vapor. Evapotranspiration is a collective term describing two processes by which this return occurs. Some water is directly evapo-



PRECIPITATION (44 in.) = SURFACE RUNOFF (10 in.) + GROUNDWATER DISCHARGE (11 in.) + EVAPOTRANSPIRATION (23 in.) + STORAGE (0 in.)

Figure 1. The annual hydrologic budget for Lebanon County. (To convert inches to gallons per day, multiply inches x 47,520 x area in square miles.)

rated from wetted surfaces (parking lots, streets, and rooftops), bodies of water (puddles, ponds, streams, and lakes), and moist soil. Water that has penetrated to the root zone of living plants is often absorbed and released to the atmosphere through the process of transpiration. The amount of evapotranspiration is determined by the length of the growing season, amount and timing of rainfall, temperature, humidity, and numerous other climatological factors. Soil characteristics, type of vegetation, and depth to the water table also affect the amount of evapotranspiration.

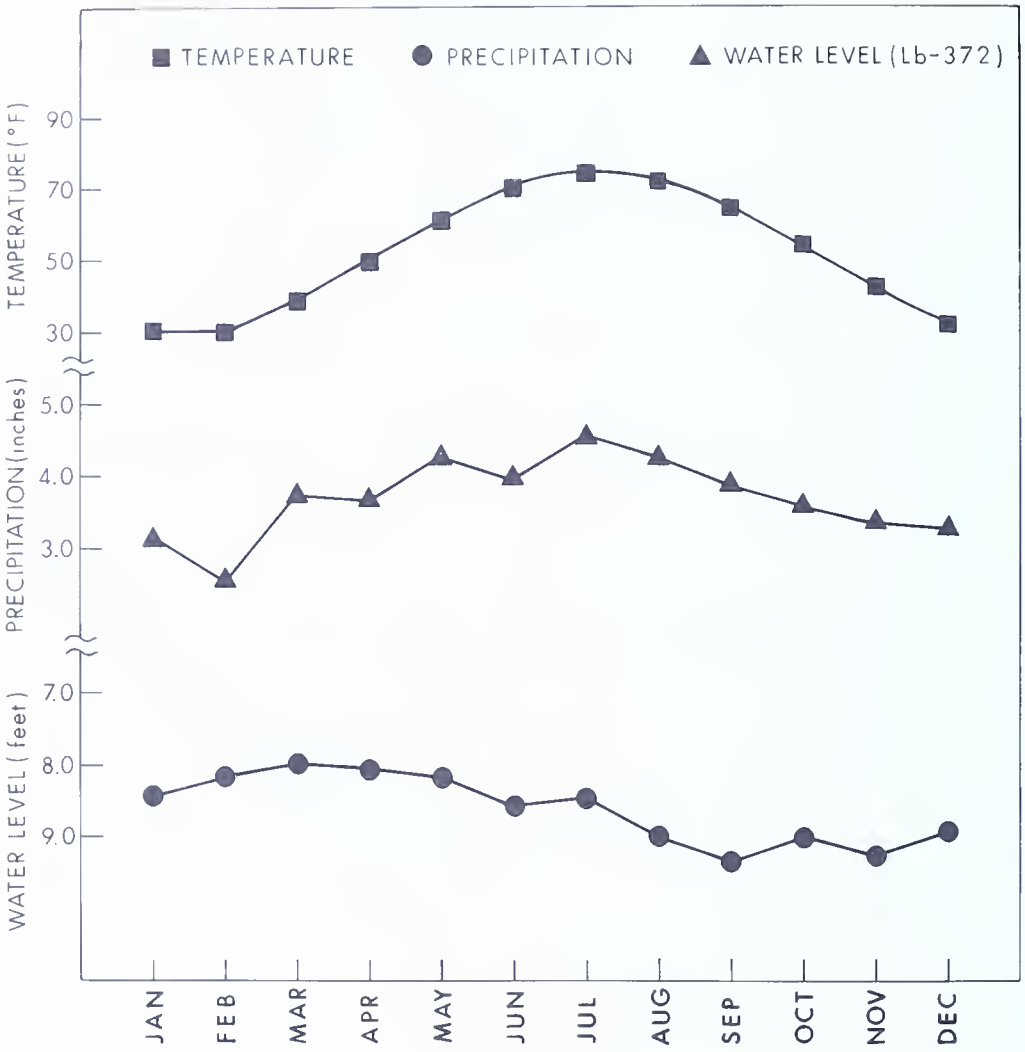


Figure 2. Mean temperature and precipitation at Lebanon (1931–60), and mean water level in well Lb–372 (July 1973–April 1982).

The average monthly water levels of the U.S. Geological Survey's observation well Lb–372 in Myerstown are presented in Figure 2. Water levels are highest in March and April when both snow melt and precipitation recharge the groundwater zone. From mid-May through September, precipitation increases but groundwater levels decline. During the growing season, high summer temperatures increase the amount of evaporation and transpiration by plants; thus, little precipitation recharges the groundwater system. By the end of December, however, normal groundwater levels have usually been restored.

The average annual water loss due to evapotranspiration in Lebanon County is calculated to be 23.1 inches (Stuart and others, 1967), which represents 52 percent of the average annual rainfall. During drought years, this percentage may increase by 10 to 20 percent.

STREAMFLOW AND BASEFLOW

Almost all precipitation that is not evaporated or transpired by plants leaves the county as streamflow. Annual stream discharge from Lebanon County averages about 27.2 inches per year. The average annual discharge from Lebanon County for Swatara Creek is about 261 Mgal/d; for Tulpehocken Creek, about 48 Mgal/d; and for Stony, Conewago, and Hammer Creeks, collectively, about 54 Mgal/d.

Baseflow or fair-weather flow is the groundwater contribution to streamflow. In Lebanon County, this amounts to about 52 percent of total streamflow. The average annual baseflow of Swatara Creek is 128 Mgal/d, 49 percent of total streamflow (Stuart and others, 1967). Tulpehocken Creek has an average annual baseflow of approximately 37 Mgal/d, 76 percent of total streamflow. Stony, Conewago, and Hammer Creeks collectively have an annual groundwater discharge of about 26 Mgal/d, 48 percent of total streamflow.

The percent of baseflow is largely dependent on the amount of carbonate rock in the watershed area. Stony, Conewago, Swatara, and Hammer Creeks, which have the lowest baseflow percentages, are underlain almost entirely by sandstones and shales. For the carbonate and shale watershed area of Tulpehocken Creek, baseflow is much higher (76 percent). Quittapahilla Creek, which drains most of the carbonate valley and then traverses a short section of shale to discharge into Swatara Creek, had an average baseflow of 39 Mgal/d, 87 percent of total streamflow, during the 1961 water year (Meisler, 1963).

AREAL GROUNDWATER YIELDING CAPABILITY

The maximum amount of water available for consumptive use can be estimated as groundwater discharge per unit of land area. This figure represents an approximate upper limit of groundwater available for withdrawal for development purposes. Withdrawals above this limit would lower regional groundwater levels.

Groundwater availability varies primarily with bedrock lithology and structure. The shales and sandstones of the Swatara Creek basin above Harpers Tavern are capable of yielding an average of 370 (gal/min)/mi^2 (gallons per minute per square mile) for consumptive use. Two hundred seventy-eight (gal/min)/mi^2 is available from the Triassic sediments in the southern part of the county (Taylor and Werkheiser, in press). The largest sustained yields are available in the carbonate valley, drained by Quittapahilla and Tulpehocken Creeks. According to James Gerhart (personal communication), the aquifers of the Lebanon Valley are capable of yielding an average of 640 (gal/min)/mi^2, or 87.5 Mgal/d. Current water use in Lebanon County totals about 34 Mgal/d. Groundwater development of the car-

bonate aquifers is recommended to meet much of the future water needs of the county.

HYDROGEOLOGY

GEOLOGIC SETTING

Most of the county is a broad, gently rolling valley (Figure 3). It is underlain by Ordovician shales and sandstones in the north, and Ordovician and Cambrian limestones and dolomites south of the Annville-Lebanon-Myerstown area. The Lebanon Valley is structurally complex. The carbonate rocks are part of the overturned south limb of a recumbent synclinorium (large downfold) (Geyer and others, 1958; Gray and others, 1958). Although progressively younger beds crop out northward across the carbonate valley, bedding generally dips to the south and strikes N60°E to N80°E. The shales and sandstones to the north are described in this report as lithotectonic units of the Hamburg sequence. These lithic (rock) assemblages were probably thrust or gravity-slide slices that were "stacked" in their present order and then thrust as a single complex sheet over the Martinsburg Formation (Wood and MacLachlan, 1978). Although some lime-

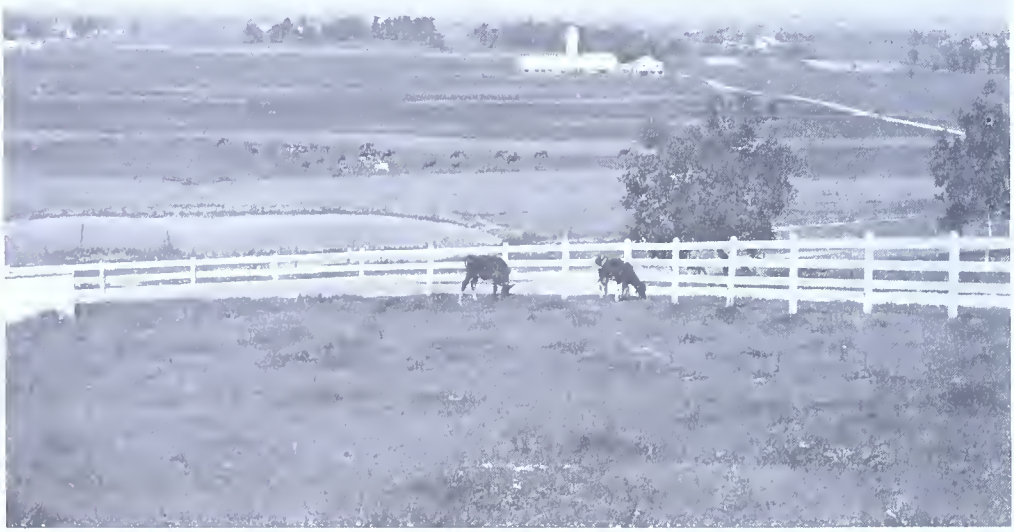


Figure 3. View of the carbonate valley, looking north from Schaefferstown.

stone does occur in the Hamburg sequence (Plate 1), the rocks are collectively referred to in this report as noncarbonate.

The central lowland is bordered on the north side by a series of parallel valleys and ridges (Figure 4). The mountains rise 1,000 feet or more above the adjacent lowland to a maximum elevation of about 1,650 feet above sea level on Stony Mountain. The area is underlain primarily by sandstone, siltstone, and shale. The highest elevations are supported by coarse- to medium-grained sandstones, conglomerates, and quartzites.

Figure 4. Blue Mountain, as viewed from Jonestown.

The carbonate valley is bounded to the south by the Furnace Hills among others, hereafter referred to as the Triassic hills (Figure 5), and by South Mountain. Sandstone and quartz conglomerate intruded by diabase dikes and sills form most of the Triassic hills. Limestone conglomerate occurs locally near Schaefferstown.

South Mountain occupies the southeastern corner of the county. It is principally composed of Precambrian gneisses and metadiabase. The northwestern border and highest elevations are underlain by Paleozoic sandstone and quartzite dipping 30 to 50 degrees to the northwest.

GEOLOGIC AND WATER-BEARING CHARACTERISTICS OF THE ROCK UNITS

The following narrative and series of frequency tables describe the geologic and water-bearing characteristics of the rock units in Lebanon Coun-

Figure 5. View across the carbonate valley to the Triassic hills in the south.

ty. Reported yields range from less than 1 to 1,800 gal/min. Data on 843 wells drilled or dug in geologic formations that underlie the county are listed in Table 9. Data on 25 springs are listed in Table 10. Plate 1 shows the areal distribution of the rock units and locations of the wells and springs used to describe the water-bearing properties of these rock units.

Diabase

Diabase, of Triassic age, occurs throughout the Triassic hills in the southern part of the county. It intrudes the sedimentary sandstones and quartz conglomerates of the Hammer Creek Formation and, to a lesser extent, the limestones and dolomites adjacent to the Triassic hills and South Mountain. Diabase occurs as large and small intrusive bodies of hard, massive, medium- to coarse-grained, dark-gray rock.

Diabase yields small supplies of moderately hard water that are marginally adequate to inadequate for domestic use. Reported yields range from 1 to 40 gal/min, and the median is 5 gal/min. The median specific capacity is 0.03 (gal/min)/ft. Wells yielding 3 gal/min or less may require supplemental storage (either well-bore storage or surface tanks) to meet minimum domestic needs. The overall quality of the water is commonly poor due to the very shallow circulation system in the aquifer (Wood, 1980). Water supplies are easily contaminated by improper sewage-disposal practices.

Hammer Creek Formation

The Hammer Creek Formation, of Triassic age, forms the hills in the southern part of the county. It is predominantly a red, gray, and brown, very fine to coarse-grained sandstone interbedded with a coarse quartz conglomerate, which forms nearly all the higher hills within the outcrop area and some of the prominent ridges. Limestone conglomerate occurs locally near Schaefferstown. The Hammer Creek Formation ranges from 9,400 to 12,200 feet in thickness (Wood, 1980).

The Hammer Creek sandstone yields good-quality, moderately hard water; the median nondomestic yield is 90 gal/min. The quartz conglomerate yields soft water, low in dissolved solids, having a median pH of 5.9. The median nondomestic well yield in the quartz conglomerate is 120 gal/min. The limestone conglomerate was not studied; however, it is probably a good aquifer. All lithologic units are capable of yielding adequate water quantities for industrial and municipal supply systems. It should be noted, however, that the long-term yield of a well may be no more than one half to one third of the test yield (Wood, 1980).

New Oxford Formation

The New Oxford Formation, of Triassic age, is red to purplish-red shale, sandstone, and mudstone interspersed with beds of light-colored micaceous sandstone, arkose, and conglomerate.

Data were not available in Lebanon County to study the water-bearing properties of this aquifer. In nearby Lancaster County, groundwater in the New Oxford Formation is moderately hard and generally of good quality. Yields adequate for domestic supply can usually be obtained from wells 150 feet deep or less.

Llewellyn Formation

The Llewellyn Formation, of Middle to Late Pennsylvanian age, is gray, fine- to coarse-grained sandstone, siltstone, shale, and conglomerate containing repetitive sequences of anthracite coals. It underlies Rausch Creek Valley and the southern slope of Stony Mountain.

Data were not available in Lebanon County to study the water-bearing properties of this aquifer. In nearby counties, the Llewellyn Formation is capable of yielding adequate water supplies to industry and small communities; however, acid mine drainage has in places rendered the groundwater unusable for most purposes.

Pottsville Group

The Pottsville Group, of Early to Middle Pennsylvanian age, includes gray conglomerate, fine- to coarse-grained sandstone, siltstone, and shale,

as well as minable anthracite coals. It is about 1,500 feet thick and underlies Stony and Sharp Mountains.

Data were not available in Lebanon County to study the water-bearing properties of this aquifer. In nearby counties, the Pottsville Group is capable of yielding adequate water quantities to industry and public supply systems. However, high iron, low dissolved-solids concentrations, and low pH values make the water quality undesirable for some uses.

Mauch Chunk Formation

The Mauch Chunk Formation, of Late Mississippian age, consists of interbedded grayish-red sandstone, siltstone, and shale. It forms the valley between Second and Sharp Mountains and is estimated to be about 3,200 feet thick.

Data were not available in Lebanon County to study the water-bearing properties of this aquifer. In nearby counties, the Mauch Chunk Formation yields moderate to large quantities of good-quality water to public water suppliers and industry. Adequate domestic supplies are usually reached at depths of 200 feet or less. The Mauch Chunk Formation is the most important aquifer in the anthracite coal region.

Pocono Formation

The Pocono Formation, of Early to Late Mississippian age, is predominantly a light-gray to buff, medium-grained, crossbedded sandstone containing some interbedded siltstone; it is commonly conglomeratic at the base and in the middle. The Pocono forms the steep northern slope of Second Mountain and is estimated to be 1,100 feet thick.

No data were available to study this aquifer in Lebanon County; however, well data in nearby counties suggest that the groundwater is low in dissolved solids and generally of good quality. Well yields should be adequate for domestic supply in most cases.

Spechty Kopf Formation

The Spechty Kopf Formation, of Late Devonian to Early Mississippian age, is light- to olive-gray, fine- to medium-grained, crossbedded sandstone and siltstone. It is exposed along the crest of Second Mountain and has an estimated thickness of 500 feet.

Only minimal data were available in Lebanon County to study this aquifer. Due to its high topographic position, well yields are probably low. Failure to obtain adequate domestic supplies may be expected.

Catskill Formation

The Catskill Formation, of Late Devonian age, is a succession of grayish-red sandstone, siltstone, claystone, and some conglomerate, generally in fining-upward cycles. The Duncannon, Clarks Ferry, Sherman Creek, and Irish Valley Members have an estimated thickness of 6,900 feet in Lebanon County and extend southward from the crest of South Mountain to the center of the next valley.

Generally, yields for domestic supply should be adequate. Four domestic wells in hillslope settings in the Sherman Creek Member had yields ranging from 3 to 45 gal/min and well depths ranging from 141 to 301 feet. Water from one well (Lb–1057) in the Catskill Formation was chemically analyzed and found to be soft and to have a high iron concentration and low pH value. Soft water that has a low pH tends to dissolve metal plumbing.

Trimmers Rock Formation

The Trimmers Rock Formation, of Late Devonian age, is predominantly an olive-gray siltstone and shale, characterized by graded bedding. It is a valley former in the northern part of the county, and is estimated to be about 2,000 feet thick.

Yields in the Trimmers Rock Formation should be adequate for domestic supply. Four domestic wells in various topographic settings ranged in yield from 7 to 25 gal/min, and well depths ranged from 161 to 206 feet. Chemical analyses of samples from three wells showed the water to be soft and low in pH, thus potentially corrosive to metal plumbing. One of the three samples exceeded the maximum recommended limit for iron (U.S. Environmental Protection Agency, 1975).

Mahantango Formation

The Mahantango Formation, of Middle Devonian age, is predominantly gray, brown, and olive shale and siltstone. It occurs in a valley in the mountainous northern part of the county and reaches an estimated thickness of 1,750 feet.

This aquifer should yield adequate supplies to domestic wells. A chemical analysis for one well (Lb–718) showed that the water is very soft, has a low pH, and is thereby potentially corrosive to plumbing.

Onondaga Formation through Poxono Island Formation, Undivided

This series of formations, of Late Silurian to Middle Devonian age, is composed primarily of gray calcareous sandstone and shale interbedded

with limestone and dolomite. Together, the units form a narrow, 6-mile-long band across the north face of Blue Mountain.

These aquifers have a limited aerial extent in Lebanon County. The type of rock and the hillside topographic position suggest that adequate yields for domestic supplies should be obtainable.

Bloomsburg Formation

The Bloomsburg Formation, of Early to Late Silurian age, is predominantly grayish-red, thin- and thick-bedded shale, siltstone, and sandstone in fining-upward cycles. It is exposed across the county on the north face of Blue Mountain and has a measured thickness of 1,524 feet (Wood and others, 1969).

The water-bearing properties of this aquifer were not studied in Lebanon County; however, in adjacent Schuylkill County, nondomestic wells have a median reported yield of 130 gal/min (Biesecker and others, 1968).

Shawangunk, Rose Hill, and Tuscarora Formations

The Rose Hill Formation, of Early Silurian age, is an olive-gray, fossiliferous shale that weathers pale yellowish brown. It crops out along the steep upper slope of Blue Mountain. The Tuscarora Formation, of Early Silurian age, is white to gray sandstone (orthoquartzite) containing minor interbedded shale, and is locally conglomeratic at the base. It is 400 feet thick at the crest of Blue Mountain. Both the Rose Hill and Tuscarora Formations grade into the Shawangunk Formation in the northeastern part of the county. The Shawangunk Formation, also of Early Silurian age, is principally light- to dark-gray, fine- to very coarse grained sandstone and conglomerate containing shale interbeds. It crops out along the upper part of the steep northern face of Blue Mountain as well as on the crest.

Because of their high elevation and relative inaccessibility, these aquifers are rarely tapped by wells in Lebanon County. In nearby counties, they generally yield sufficient quantities of soft water for domestic use.

Hamburg Sequence

The Hamburg sequence, of Late Cambrian to Late Ordovician age, is represented in Lebanon County by a series of lithotectonic units. Thicknesses of these units are unknown. The Yellow Breeches thrust plate, which is in this report included in the Hamburg sequence, is of complex origin and structure, and may have been emplaced before, during, or after the lithotectonic units of the Hamburg sequence.

Yellow Breeches Thrust Plate

The Yellow Breeches thrust plate consists predominantly of dark-gray shale and poorly sorted siltstone. It is calcareous at the base, weathers olive brown to tan, and has minor interbeds of argillaceous sandstone.

Reported domestic yields range from 1 to 50 gal/min, and the median yield is 5 gal/min. A single specific capacity of 0.4 (gal/min)/ft was reported.

The water in the Yellow Breeches thrust plate is moderately hard (the median hardness is 103 mg/L) and has a median specific conductance of 245 micromhos. Of 12 samples analyzed, four exceeded the maximum recommended limit for iron and 10 exceeded the limit for manganese (U.S. Environmental Protection Agency, 1975). Hydrogen sulfide odors are a common complaint of well owners.

Lithotectonic Unit 8

Lithotectonic unit 8 consists predominantly of gray and brick-red shale and minor beds of fine-grained brown sandstone and limestone. Reported yields range from 2 to 575 gal/min; the median domestic and nondomestic yields are 15 and 50 gal/min, respectively. The highest yields are available from the limestone interbeds. The median specific capacity for nondomestic wells is 17.5 (gal/min)/ft.

Water from lithotectonic unit 8 is moderately hard, having a median hardness of 86 mg/L; the median specific conductance is 220 micromhos. Iron and manganese are water-quality problems. Although the median iron concentration of 14 samples is 0.16 mg/L, concentrations of iron as high as 8.91 mg/L have been reported, and the median manganese concentration for 10 samples is 0.1 mg/L, twice the maximum recommended limit (U.S. Environmental Protection Agency, 1975). "Rotten egg" odors from hydrogen sulfide gas are occasionally a problem in unit 8.

Lithotectonic Unit 6

Lithotectonic unit 6 consists predominantly of greenish-brown siltstone, quartz-pebble graywacke, and shale, and also contains some red shale, sandstone, and limestone beds. The metamorphic and igneous rocks, metadiabase and andesite, also occur with these sediments.

Reported yields range from 1 to 60 gal/min, and the median domestic yield is 12 gal/min. The median specific capacity of four wells is 0.3 (gal/min)/ft. In nearby Berks County, unit 6 is one of the highest yielding units in the Hamburg sequence, having a reported median nondomestic yield of 140 gal/min (Wood and MacLachlan, 1978). However, well yields may be lower in the metadiabase.

Water in unit 6 is moderately hard and has a median specific conductance of 220 micromhos. Treatment for iron and manganese is often required in the Bunker Hills area.

Lithotectonic Unit 4

Lithotectonic unit 4 consists primarily of greenish-gray micaceous siltstone in thick to massive beds, and also contains minor beds of quartzite, thin- to medium-bedded sandy limestone, and black- and orange-weathering laminated shale (Figure 6).

Reported yields range from 4 to 50 gal/min; the median yield for domestic wells is 15 gal/min. In nearby Berks County, unit 4 is considered one of the better yielding units in the Hamburg sequence; the median nondomestic yield there is 62 gal/min (Wood and MacLachlan, 1978). The specific capacity for one well in Lebanon County was 0.35 (gal/min)/ft. The median domestic and nondomestic specific capacities in Berks County are 0.6 and 1.4 (gal/min)/ft, respectively (Wood and MacLachlan, 1978).

The moderately hard to hard water of unit 4 has a median specific conductance of 222 micromhos. Three of six samples analyzed exceeded the maximum recommended limits for iron and manganese (U.S. Environmental Protection Agency, 1975).

Figure 6. Hamburg sequence, lithotectonic unit 4, along Clear Springs Road west of Lebanon.

Lithotectonic Unit 3

Lithotectonic unit 3 consists of interbedded red siltstone and shale, olive siltstone and shale, siliceous shale, and minor beds of chert and quartzitic sandstone.

Reported yields range from 2 to 122 gal/min; the median domestic and nondomestic yields are 20 and 58 gal/min, respectively. The median domestic specific capacity from three wells is 0.53 (gal/min)/ft. In Berks County, the median domestic and nondomestic specific capacities are 0.24 and 0.47 (gal/min)/ft, respectively (Wood and MacLachlan, 1978).

The moderately hard water in unit 3 has a median specific conductance of 198 micromhos. Excessive iron concentrations and hydrogen sulfide odors are occasional problems.

Lithotectonic Unit 2

Lithotectonic unit 2 consists of interbedded limestone and micaceous shale and siltstone; minor beds of limestone conglomerate and red shale are also present. Massively bedded calcarenite is often associated with the limestone.

Reported yields range from 4 to 500 gal/min, and the median domestic yield is 15 gal/min. Two nondomestic yields of 400 and 500 gal/min were reported. The median specific capacity of three domestic wells is 0.13 (gal/min)/ft. Median domestic and nondomestic yields in Berks County are 0.29 and 1.7, respectively (Wood and MacLachlan, 1978). This unit is one of the higher yielding units in the Hamburg sequence. The water is hard to very hard and has a median specific conductance of 380 micromhos.

Lithotectonic Unit 1

Lithotectonic unit 1 consists of olive-weathering gray shale interbedded with brown and gray calcareous graywacke.

Reported yields range from 4 to 80 gal/min; median domestic and nondomestic yields are 15 and 18 gal/min, respectively. The median specific capacity for nondomestic wells is 0.93 (gal/min)/ft.

Unit 1 yields hard water and has a median specific conductance of 245 micromhos. Excessive iron and manganese may occasionally be problems.

Lebanon Valley Sequence

Martinsburg Formation

The Martinsburg Formation, of Late Ordovician age, is a gray to dark-gray shale that weathers buff. It crops out in northern Lebanon County along the south face of Blue Mountain, and is about 1,000 feet thick.

Yields should be adequate for domestic supply in the Martinsburg Formation. Six domestic wells have reported yields ranging from 8 to 60 gal/min, the median yield is 18 gal/min, and well depths range from 100 to 200 feet. Field analysis indicates that the water is moderately hard; the median hardness is 68 mg/L. Laboratory analysis was completed for one sam-

ple (Lb–1024), and the iron and manganese contents were found to exceed recommended drinking-water limits (U.S. Environmental Protection Agency, 1975).

Hershey Formation

The Hershey Formation, of Late Ordovician age, is predominantly a dark-gray argillaceous limestone. It crops out along the northern edge of the carbonate valley and reaches a maximum thickness of over 450 feet in the vicinity of Myerstown.

The shaly-silty character of this limestone makes it the least reliable source of water in the carbonate rocks. Reported domestic yields in the Hershey Formation range from 8 to 25 gal/min, and the median is 22 gal/min. Domestic specific capacities are consistently low, ranging from 0.12 to 0.44 (gal/min)/ft, and the median is 0.29 (gal/min)/ft. The median water hardness is 239 mg/L.

Myerstown Formation

The Myerstown Formation, of Late Ordovician age, is a dark-gray, medium- to fine-grained, crystalline, thin-bedded limestone. It forms a narrow band across the Lebanon Valley and has an estimated thickness of 200 to 250 feet.

The Myerstown Formation yields moderate to large quantities of very hard water; the median hardness is 239 mg/L. Specific capacities computed for two wells were 11 and 12 (gal/min)/ft (Meisler, 1963).

Annville Formation

The Annville Formation, of Middle Ordovician age, is primarily a light-gray, finely crystalline, thick-bedded, high-calcium limestone. The weathered surface of this limestone often has a white sugary texture and fluted form produced by differential weathering along bedding and cleavage planes. The Annville Formation crops out in a narrow band across the Lebanon Valley and has an estimated thickness of 250 feet. This high-calcium limestone is actively being quarried by the Bethlehem Steel Corporation at Millard quarry near Palmyra, and G. and W. H. Corson, Inc., at Calcite quarry adjacent to Avon Heights.

Reported yields in the Annville Formation range from 28 to 200 gal/min, and the median nondomestic well yield for three wells is 30 gal/min. The median specific capacity for the same three wells is 0.21 (gal/min)/ft. The median water hardness is 239 mg/L.

Beekmantown Group

Ontelaunee Formation. The Ontelaunee Formation, of Middle Ordovician age, is a light- to dark-gray, thick-bedded, crystalline dolomite that weathers dark grayish brown. It crops out across the Lebanon Valley and has a minimum thickness of 500 feet.

The Ontelaunee Formation serves as a reliable source of groundwater. Reported yields range from 3 to 750 gal/min; the medians of domestic and nondomestic wells are 11 and 200 gal/min, respectively. Of seven wells, specific capacities range from 4.2 to 330 (gal/min)/ft, and the median is 73 (gal/min)/ft. The water in the Ontelaunee Formation is very hard; the median hardness is 306 mg/L. The median specific conductance of 765 micromhos is relatively high.

Epler Formation. The Epler Formation, of Early to Middle Ordovician age, is chiefly interbedded light-gray limestone and dark-gray dolomite; it is cherty and contains numerous beds of calcarenite. The thickness ranges from 650 to 1,000 feet.

Reported yields from the Epler Formation range from 3 to 1,800 gal/min; the medians of domestic and nondomestic wells are 11 and 265 gal/min, respectively. The specific capacities of 11 domestic wells are generally low for carbonate rock. They range from 0.01 to 15 (gal/min)/ft, and the median is 1.9 (gal/min)/ft. Specific capacity is somewhat improved for wells located less than 500 feet from the higher yielding Stonehenge Formation. The median specific capacity for these wells is 9.0 (gal/min)/ft (Meisler, 1963).

The water quality of the Epler Formation is fair. The median water hardness is 291 mg/L, and the median specific conductance is 660 micromhos.

Rickenbach Formation. The Rickenbach Formation, of Early Ordovician age, is a finely crystalline, cherty, dark-gray to gray dolomite. It crops out across the valley in a narrow band 200 to 300 feet wide.

Reported yields range from 4 to 100 gal/min, and the median domestic yield of four wells is 18 gal/min. Reported specific capacities from two pumping tests are 150 and 360 (gal/min)/ft (Meisler, 1963). Although data are insufficient to fully evaluate the water-bearing properties of this aquifer, the specific-capacity figures indicate that it has the potential to yield large quantities of water to wells (Meisler, 1963). The median water hardness is 239 mg/L.

Stonehenge Formation. The Stonehenge Formation, of Late Cambrian to Early Ordovician age, is a medium-gray, crystalline limestone that is cherty in the upper part and conglomeratic at the base. It crops out in a belt approximately 600 feet in exposed thickness across the Lebanon Valley.

The Stonehenge Formation is an excellent source of groundwater, except near the underlying Richland Formation. Nondomestic yields range from 10 to 225 gal/min; 20 gal/min is the median. Specific capacities of 19 wells range from 0.03 to 250 (gal/min)/ft. Nine of the 19 wells are within 700 feet of the contact with the Richland Formation. None of these wells have reported specific capacities of over 10, and six of the nine have reported specific capacities of 1.0 or less. The median specific capacity of the remaining 10 wells is 56 (gal/min)/ft. The water in the Stonehenge Formation is very

hard (the median hardness is 239 mg/L) and has a median nitrate concentration of 6.8 mg/L.

Conococheague Group

Richland Formation. The Richland Formation, of Late Cambrian age, is a gray, thick-bedded, finely crystalline dolomite containing limestone, chert, and calcarenite interbeds; limestone chiefly occurs in the middle section. It is one of the thickest carbonate units crossing the valley, having an estimated thickness of 700 to 800 feet.

The Richland Formation is a moderately reliable source of groundwater. Reported yields range from 3 to 90 gal/min, and the median domestic yield is 11 gal/min. The specific capacities of 23 wells range from 0.01 to 68 (gal/min)/ft, and the median is 3.2 (gal/min)/ft. Seven of the 23 wells are less than 1,000 feet from the Richland-Millbach contact and have a median specific capacity of 11 (gal/min)/ft. The median specific capacity of the remaining 16 wells is 1.6 (gal/min)/ft.

Groundwater quality in the Richland Formation is similar to that in the other carbonate units. The water is very hard (the median hardness is 239 mg/L), and has a median nitrate concentration of 5.6 mg/L. The median specific conductance is 550 micromhos.

Millbach and Schaefferstown Formations. The Millbach Formation, of Late Cambrian age, is chiefly a pinkish-gray to light-gray, laminated, crystalline limestone containing algal structures and some interbedded dolomite (Figure 7). It crops out across the valley and has an estimated thickness of 500 to 550 feet. The Schaefferstown Formation, of Late Cambrian age, is very similar in lithology. It is a light- to medium-gray limestone containing shaly bands and laminae. It parallels the Millbach Formation and is 200 to 300 feet in thickness.

These adjoining limestone aquifers are the most reliable water-bearing units in the valley. Because their water-bearing characteristics are so similar, they are discussed here as a single hydrologic unit. Reported yields range from 10 to 100 gal/min, and the median domestic yield is 40 gal/min. Specific capacities of 13 domestic wells range from 0.01 to 300 (gal/min)/ft, and the median is 91 (gal/min)/ft. The median water hardness is 222 mg/L.

Snitz Creek Formation. The Snitz Creek Formation, of Middle Cambrian age, is a light- to medium-gray, coarsely crystalline dolomite, commonly oolitic and cherty. The formation is about 350 feet thick and stretches across the southern part of the Lebanon Valley.

The Snitz Creek Formation is one of the least reliable aquifers in the valley. Reported yields range from 4 to 500 gal/min, and the median domestic yield is 6 gal/min. The specific capacities of 13 domestic wells range from

Figure 7. Millbach Formation on North Kalbach Road, west of Newmanstown.

0.1 to 120 (gal/min)/ft; the median is 1.4 (gal/min)/ft. The median water hardness is 274 mg/L.

Buffalo Springs Formation

The Buffalo Springs Formation, of Middle Cambrian age, is a light- to pinkish-gray, crystalline limestone, commonly containing shaly laminae, and interbedded with light-gray crystalline dolomite. This formation is more than 700 feet thick and crops out in a belt across the southernmost section of the Lebanon Valley.

The Buffalo Springs Formation is a moderately reliable aquifer. Reported yields range from 1 to 800 gal/min; median yields of domestic and nondomestic wells are 10 and 82 gal/min, respectively. Specific capacities of 19 wells range from 0.02 to 130 (gal/min)/ft, and the median is 1.2 (gal/min)/ft. Wells near the contact of the Buffalo Springs Formation and Triassic rocks have considerably lower specific capacities. Ten of the wells are within 600 feet of this contact, and seven are within 50 feet. The median specific capacity of these 10 wells is 0.55 (gal/min)/ft. The median specific capacity of the nine wells that are more than 600 feet from the Triassic rocks is 3.4 (gal/min)/ft. The median water hardness is 222 mg/L. The median specific conductance is 550 micromhos.

Lehigh Valley Sequence

Leithsville Formation

The Leithsville Formation, of Middle Cambrian age, is predominantly a medium- to dark-gray, crystalline dolomite that is shaly in the upper part and has considerable amounts of chert in the lower part. It crops out southeast of Newmanstown and is buried under too much talus to be accurately measured.

Reported yields of five wells (both domestic and nondomestic) range from 12 to 300 gal/min, and the median is 100 gal/min. Reported specific capacities from two pumping tests are 0.81 and 1.2 (gal/min)/ft.

The water quality of the Leithsville Formation is better than most of the other carbonate rock units in the valley. The groundwater is only moderately hard (the median hardness is 103 mg/L), due to mixing with soft waters from the South Mountain rocks. Nitrate concentrations in two samples were well below the maximum recommended limit. The median specific conductance is 198 mg/L. However, where diabase has intruded the Leithsville Formation, well water can be very soft, corrosive, and high in iron and manganese (see Table 8, well Lb–1044).

Hardyston Formation

The Hardyston Formation, of Early Cambrian age, is typically a light-gray quartzite and feldspathic sandstone, and is conglomeratic at the base. It is about 600 feet thick and forms the ridge on the perimeter of the South Mountain area.

The Hardyston Formation yields good-quality, soft to moderately hard water. Reported yields of two nondomestic wells are 35 and 60 gal/min. Specific capacities of these wells are 0.35 and 0.41 (gal/min)/ft, respectively.

South Mountain

Metamorphic Rocks

The metamorphic rocks of South Mountain are Precambrian in age and include metadiabase, granitic gneiss, hornblende gneiss which includes gabbro gneiss and minor biotite-hornblende gneiss, and graphitic gneiss including metasediments intermediate in composition between graphitic gneiss and hornblende gneiss.

Reported yields from seven wells range from 1 to 25 gal/min, and the median is 10 gal/min. Twenty-five percent of the wells yield 3 gal/min or less. These wells may require supplemental storage to meet minimum domestic water supply needs. As is the case with diabase, the metamorphic rocks may have a shallow circulation system, and water supplies can be easily contaminated by improper sewage-disposal practices. The water samples analyzed

showed that the groundwater is soft and low in pH, a condition that tends to dissolve metal plumbing.

SUMMARY OF WELL YIELD AND CONSTRUCTION CHARACTERISTICS

Table 2 gives the frequency distribution of reported well yields and the specific capacity for selected rock units. The ability of a well to yield water is generally estimated by the driller at the time the well is completed by measuring the rate at which water must be removed from the well in order to lower the water level near the bottom of the well; the withdrawal rate obtained is called the reported yield. There are several factors that limit the accuracy of this yield estimate, two of which are: (1) as the yield increases it becomes increasingly difficult to lower the water level to the bottom of the well; and (2) the tests are generally of short duration (1 hour or less).

The reported yields can be used to evaluate the suitability of a rock unit to meet various domestic and nondomestic needs. For example, if 25 percent of the well yields reported for a rock unit are greater than 100 gal/min, then that aquifer is probably suitable for development of industrial and municipal supplies. This is true for several rock units in Lebanon County: the Hammer Creek, Buffalo Springs, Millbach, Schaefferstown, Epler, and Ontelaunee Formations, and some of the limestones in the Hamburg sequence rocks. Rock units in which 25 percent of the wells have reported yields of 3 gal/min or less will frequently require supplemental storage in order to meet minimum domestic supply needs (either well bore storage or surface tanks). Rock units meeting this criterion are diabase, the Yellow Breeches thrust plate, and the metamorphic rocks of South Mountain.

A more accurate measure of a well's yielding capability is made by pumping the well at a constant rate and measuring the amount that the water level has been lowered after a given time; this is called the specific capacity (discharge divided by drawdown) (Figure 8). Most of the specific-capacity data presented in this report are based on pumping-test results reported by drillers and consultants. Tests in the carbonate valley were conducted by the U.S. Geological Survey.

Statistical information for both domestic and nondomestic wells is listed in Tables 2 and 3. Domestic wells are drilled only deep enough to provide residences with 5 to 10 gal/min, and therefore usually only characterize the upper yielding zones of the aquifers. Most nondomestic wells, however, tap deeper zones and generally have higher specific capacities and yields. For example, median well depths and specific capacities for domestic wells compared to nondomestic wells in the Hammer Creek Formation are 100 and 210 feet, and 0.36 and 0.95 (gal/min)/ft, respectively. Also, nondomestic wells have slightly larger diameters and are almost exclusively located in hillslope and valley settings. By penetrating a greater thickness of an aqui-

Table 2. *Summary of Water-Yielding Capability of Rocks*

Rock unit	Type[2]	Specific capacity[1] ((gal/min)/ft)				Reported yield[1] (gal/min)			
		Number of wells	25 percent	50 percent (median)	75 percent	Number of wells	25 percent	50 percent (median)	75 percent
Diabase	D	6	.33	.03	.01	7	8	5	1
Hammer Creek Formation	D	38	.73	.36	.23	45	30	20	15
	N	19	3.1	.95	.5	26	175	60	35
Sherman Creek Member of Catskill Formation	D	—	—	—	—	4	32.5	13	4.5
Yellow Breeches thrust plate	D	—	—	—	—	21	12	5	1.5
Hamburg sequence,	D	4	.56	.25	.04	30	20	15	7
lithotectonic unit 8	N	5	17.5	12	1.5	15	350	50	15
Hamburg sequence, lithotectonic unit 6	D	4	1.18	.3	.05	28	20	12	8
Hamburg sequence, lithotectonic unit 4	D	—	—	—	—	13	22.5	15	8.5
Hamburg sequence,	D	3	—	.53	—	27	40	20	8
lithotectonic unit 3	N	—	—	—	—	4	115	58	6
Hamburg sequence, lithotectonic unit 2	D	3	—	.13	—	20	27.5	15	10
Hamburg sequence,	D	4	.17	.14	.09	18	25.5	15	7.5
lithotectonic unit 1	N	3	—	.93	—	6	60	17.5	12
Martinsburg Formation	D	—	—	—	—	6	40	17.5	15
Hershey Formation	D	4	.43	.29	.14	4	24	22	14
Annville Formation	N	3	—	.21	—	3	—	30	—
Ontelaunee Formation	D	—	—	—	—	3	—	11	—
	N	6	180	60	14	11	600	200	75

Epler Formation	D	11	8.5	1.3	.16	7	25	11	3
	N	—	—	—	—	10	600	265	60
Rickenbach Formation	D	—	—	—	—	4	82.5	18	4.5
Stonehenge Formation	D	15	61	3.8	.49	—	—	—	—
	N	4	80	.2	.1	6	25	20	17
Richland Formation	D	21	19	2.4	.18	13	23	11	6
Millbach and Schaefferstown Formations, undivided	D	13	155	91	3	7	100	40	20
Snitz Creek Formation	D	13	9	1.4	.24	5	19	6	5
Buffalo Springs Formation	D	12	14	2.8	.2	4	11	10	6
	N	7	1.2	.76	.08	12	159	82	19
Leithsville Formation	N	—	—	—	—	3	—	100	—
Hornblende gneiss	D	3	—	.16	—	4	22.5	12	3

[1] Value (specific capacity or reported yield) is exceeded by indicated percentage of wells.

[2] D, domestic; N, nondomestic.

A = Depth to static-water level in feet
B = Depth to pumping-water level in feet
Drawdown = B-A
C = Maximum possible drawdown
Q = Yield in gallons per minute

$$\text{Specific capacity} = \frac{\text{Yield}}{\text{Drawdown}} = \frac{Q}{B\text{-}A}$$

For example: water stands 62 feet below the surface before a well is pumped (A = 62 feet). The pump is run for an hour and is measured by filling a 55-gallon drum in 10 minutes ($Q = \frac{55}{10} = 5.5$ gallons per minute). The water level is then found to be 73 feet below the surface of the ground (B = 73 feet). The drawdown is then 73 – 62 = 11 feet and the specific capacity is $\frac{5.5}{11} = 0.5$ gallon per minute per foot of drawdown. If the well is 100 feet deep, the maximum possible drawdown (C) is 100 – 62 = 38 feet. Therefore, the maximum rate at which the well could ever be pumped is 0.5 $\frac{\text{gpm}}{\text{feet}}$ X 38 feet = 19 gallons per minute.

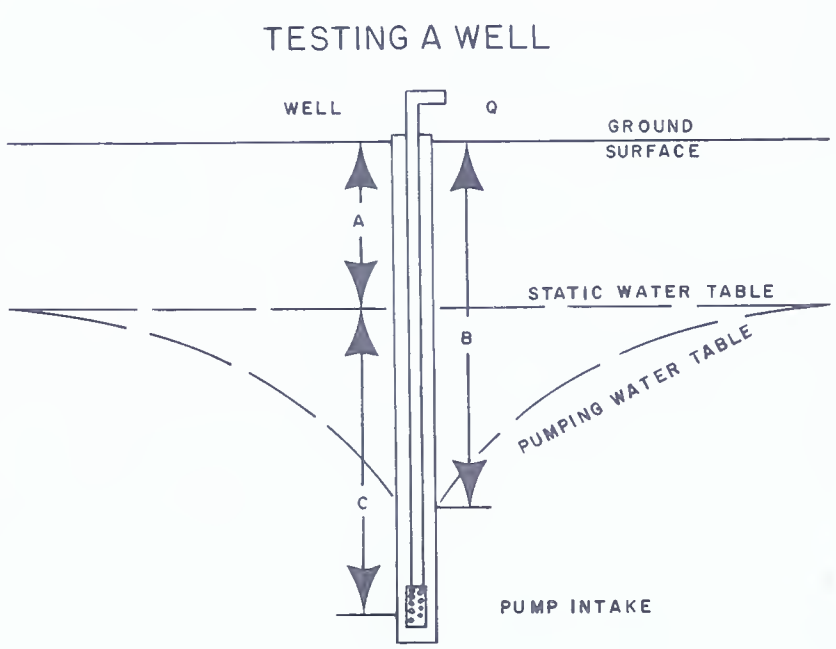


Figure 8. Diagram showing how specific capacity is computed (from Landers, 1976).

fer, the nondomestic wells allow a more accurate assessment of an aquifer's capability.

Table 3 lists median and maximum casing lengths and water-level depths. A summary of well completion data is useful in making predrilling estimates and in comparing well construction characteristics among rock units. For example, the difference between the median depths of domestic wells in the Ontelaunee Formation and the remaining units indicates that adequate yields are obtained at a much shallower depth and therefore at lower cost from the Ontelaunee Formation.

FACTORS THAT AFFECT WELL YIELD

Lithology

The lithology of an aquifer is one of the most significant factors that affects well yield. The Lebanon Valley limestones and dolomites have the highest median specific capacity for domestic wells in the county, 4.2 (gal/min)/ft. In comparison, the sandstones and quartz conglomerates of the Hammer Creek Formation and the shales and graywackes of the Hamburg sequence have medians of 0.36 and 0.15 (gal/min)/ft, respectively. The lowest median specific capacities are reported for the igneous and metamorphic rocks. The median for diabase is 0.03 (gal/min)/ft and the median for the metamorphic rocks of South Mountain is 0.13 (gal/min)/ft. The Lebanon Valley carbonates clearly provide the largest reliable yields in the county. Assuming equivalent drawdowns, a well in the carbonates is capable of yielding 12 times the water of a well in the Hammer Creek Formation and 28 times the water of a well in the Hamburg sequence rocks.

Diabase is the least reliable aquifer in the county. Domestic yields in diabase are often marginal (3 gal/min or less) and require additional well depth or surface tanks to provide supplemental storage. Wood (1980) found that diabase is such a poor aquifer that it tends to act as a barrier to groundwater movement in the Hammer Creek Formation and the adjacent Cambrian limestones and dolomites.

Geologic Structure

Geologic structure, which includes faults, folds, other fractures, and orientation of the rock layers (bedrock dip), often exerts an important influence on the yield of wells. Detailed knowledge of local structure can be a valuable aid in the selection of high-yield well sites. Plate 1 shows the major faults in Lebanon County as well as some site-specific information on the orientation of the bedrock layering.

Fractured bedrock will yield more water to wells than nonfractured bedrock. Many valleys and depressions are localized along fractures or fracture zones; thus wells located in these settings will have a high probability of

Table 3. *Summary of Well, Casing, and Water-Level Depths*

Rock unit(s)	Type[1]	Number of wells	Well depth (feet)		Number of wells	Casing depth (feet)		Number of wells	Depth to water (feet)	
			Median	Maximum		Median	Maximum		Median	Maximum
Diabase	D	9	200	360	7	29	50	8	21	95
Hammer Creek Formation	D	51	100	280	45	42	111	49	35	140
	N	27	210	806	22	44	128	22	29	102
Sherman Creek Member of Catskill Formation	D	4	262	301	4	72	82	—	—	—
Trimmers Rock Formation	D	2	204	206	2	56	84	—	—	—
	N	2	170	178	2	63	82	1	—	32
Yellow Breeches thrust plate	D	25	225	375	23	61	82	13	25	130
Hamburg sequence, lithotectonic unit 8	D	46	150	421	37	68	138	26	28	100
	N	16	212	600	14	63	139	6	30	74
Hamburg sequence, lithotectonic unit 6	D	29	175	400	26	62	112	16	32	50
Hamburg sequence, lithotectonic unit 4	D	13	136	300	13	43	82	7	18	44
Hamburg sequence, lithotectonic unit 3	D	27	150	300	26	62	123	7	41	65
	N	4	274	455	3	52	62	3	35	40
Hamburg sequence, lithotectonic unit 2	D	21	125	401	19	61	117	8	20	62
	N	2	165	200	2	59	79	2	32	33
Hamburg sequence, lithotectonic unit 1	D	18	123	381	17	51	105	8	13	38
	N	6	160	250	6	42	82	3	25	44
Martinsburg Formation	D	6	162	200	6	51	101	—	—	—
Hershey Formation	D	21	100	230	3	37	96	15	15	90
	N	4	237	495	3	36	38	4	18	22
Myerstown Formation	D	9	100	250	3	20	101	5	23	57
	N	1	—	165	—	—	—	2	24	25

Annville Formation	D	10	134	500	2	102	104	7	22	72
	N	3	230	355	3	43	49	3	18	37
Ontelaunee Formation	D	13	68	450	4	30	38	9	21	123
	N	16	236	626	9	42	82	16	16	149
Epler Formation	D	38	100	448	7	36	91	35	38	84
	N	15	115	485	7	38	66	11	15	70
Rickenbach Formation	D	15	142	643	5	22	127	10	27	70
Stonehenge Formation	D	51	94	366	4	61	100	49	39	71
	N	9	385	545	5	103	184	6	43	54
Richland Formation	D	85	120	800	18	61	200	78	38	497
	N	2	120	123	2	47	74	2	69	71
Millbach and Schaefferstown	D	40	95	385	9	50	100	36	31	140
Formations, undivided	N	3	500	505	1	—	53	2	22	24
Snitz Creek Formation	D	43	120	405	10	21	60	32	35	85
	N	1	—	200	1	—	85	1	—	43
Buffalo Springs Formation	D	40	82	350	5	45	80	36	45	90
	N	15	300	500	12	59	120	14	55	80
Leithsville Formation	D	2	142	158	2	130	156	—	—	—
	N	3	173	360	2	132	156	2	51	52
Hardyston Formation	N	4	429	678	4	284	367	2	84	162
Hornblende gneiss	D	4	160	501	4	56	68	3	12	38
	N	1	—	640	1	—	60	—	—	—

[1] D, domestic; N, nondomestic.

penetrating fractured bedrock. Features that are reported to be good indicators of fractured bedrock are faults and fracture traces (natural linear features observed on aerial photographs).

Well yields generally decrease with increasing dip of strata. This probably occurs for two reasons: (1) more of the openings that normally occur along bedding (bedding-plane partings) will be penetrated by a well in nearly horizontal strata than in steeply inclined strata; and (2) the cone of depression that develops when a well is pumped will spread more easily in flat-lying strata.

Detailed discussions of the relationship of geologic structure to well yields in rocks present in, or similar to, those in Lebanon County may be found in reports by Carswell and others (1968), Meisler (1963), Wood and MacLachlan (1978), and Wood (1980).

Topography

Topographic position usually affects the yield of a well. Specific capacities are generally reported to be highest for wells located in valleys and lowest for wells located on hilltops. Specific capacities of hillside wells fall somewhere in between. The reason for this distribution is that valleys usually form where the chemical and physical characteristics of the rocks make them more susceptible to weathering, and the concentration of fractures and openings in the rocks is greater. Hilltops are usually underlain by more resistant rock types that have fewer fractures. In addition, valleys are the collecting areas for water from the surrounding hills, and, therefore, transmit greater amounts of water than hillside and hilltop locations.

Topography affects well yields most significantly in the Triassic hills, South Mountain, and probably the parallel ridge and valley area north of Blue Mountain. Wood (1980) found that domestic wells had the poorest reported yields on hilltops and the best reported yields in valleys; however, he suggested that an abundance of shallow yielding zones in valleys may be a contributing factor. Deep nondomestic wells in both hilltop and valley settings of the Hammer Creek Formation showed little difference in the specific capacities reported.

Topography has less of an effect on well yields in the gently rolling central lowland of the county. The specific capacities reported for domestic valley wells in the Hamburg sequence are two to four times those reported for wells in hillside settings.

Depth to Water-Bearing Zones

The yield of a well largely depends on the size and distribution of the water-bearing zones open to the well. In Lebanon County, the water-bearing zones consist mostly of secondary openings along bedding planes, joints, cleavage, and faults and, to a much lesser degree, in the spaces between

mineral grains that make up the rock. In carbonate rocks, some of the fracture openings have been enlarged by solution. Openings as large as 1 foot in diameter have been reported in the carbonate units of Berks County; however, openings in most rock units are only a fraction of an inch wide (Wood and MacLachlan, 1978). The total contribution of a deep zone to the yield of a well is often greater than that of a shallower zone having a higher specific capacity, because the deeper zone has a greater available drawdown (Figure 8). For example, a zone that has a specific capacity of 1 gal/min per foot of drawdown, located 50 feet below the static water level of a well, could yield a maximum of 50 gal/min. If the same zone is located 100 feet below the static water level, the maximum yield could be increased to 100 gal/min.

Table 4 summarizes the data available for water-bearing zones. The denominator of the fraction represents the number of wells that have penetrated each depth range. Therefore, the denominator for the shallowest range of any formation, 0 to 50 feet, indicates the total number of wells for which data on depth to water-bearing zones were obtained. The numerator of the fraction indicates the relative abundance of zones for each depth range. In the Hammer Creek Formation, 10 water-bearing zones were reported for 0 to 50 feet of well depth, and a total of 58 wells penetrated that range. Decreases in the number of zones below 300 feet, however, are due in part to the lack of well data and to the difficulty in discerning additional yielding zones after several have been penetrated.

The table suggests the practical depth to drill a well, by formation. Most of the yielding zones in the coarse-grained Hammer Creek Formation are within the first 100 feet of the land surface. Below 150 feet, the number sharply drops off. Water-bearing zones have been reported, however, between 500 and 800 feet in nearby counties, but drilling to these depths is recommended only if the need is great enough (Wood, 1980) and the shallower zones have not provided enough water.

The majority of the water-bearing zones in the Hamburg sequence rocks occur between 50 and 150 feet. Although zones have been reported to a maximum depth of 398 feet, it is unlikely that significant yields will be obtained from zones below 300 to 400 feet.

Although the number of water-bearing zones penetrated in the carbonate rocks is less than that of the Hamburg sequence rocks, the yield per zone is generally higher. The deepest reported yielding zone for the carbonate rocks is 540 feet in the Stonehenge Formation. Wood and others (1972), working in similar rocks in Lehigh County, found that the water-bearing zones become closed between 600 and 850 feet, and that below 850 feet, minimal groundwater circulation occurs.

Water-bearing zones in diabase and the metamorphic rocks are shallow, and few zones have been reported below 200 feet. Deeper zones exist, but they are very low yielding. Generally speaking, if sufficient quantities of

Table 4. *Summary of Data on Water-Bearing Zones*

Rock unit	Ratio of number of water-bearing zones reported for a specified depth range to number of wells penetrating this range[1]											Deepest zone
	Depth range, in feet											
	0–50	51–100	101–150	151–200	201–250	251–300	301–350	351–400	401–450	451–500	>500	
Diabase	2/7	3/7	2/6	5/6	1/4	1/3	0/2	1/1	—	—	—	360
Hammer Creek Formation	10/58	76/58	37/35	12/21	6/11	5/7	3/4	0/3	1/1	0/1	—	445
Sherman Creek Member of Catskill Formation	0/4	0/4	3/4	3/3	0/3	1/2	0/1	—	—	—	—	287
Trimmers Rock Formation	0/4	3/4	4/4	1/4	1/2	—	—	—	—	—	—	205
Yellow Breeches thrust plate	1/21	19/21	9/18	1/13	1/11	3/11	0/4	1/2	—	—	—	360
Hamburg sequence, lithotectonic unit 8	2/32	23/32	27/32	17/22	6/16	5/9	3/4	3/3	0/2	0/1	0/1	390
Hamburg sequence, lithotectonic unit 6	2/28	15/28	20/26	8/18	8/12	5/9	3/5	1/3	0/1	—	—	383
Hamburg sequence, lithotectonic unit 4	2/13	9/13	11/12	3/4	2/3	1/1	—	—	—	—	—	285
Hamburg sequence, lithotectonic unit 3	7/26	22/26	25/26	4/11	5/7	2/4	0/1	1/1	—	—	—	398
Hamburg sequence, lithotectonic unit 2	1/20	18/20	18/17	3/7	1/3	0/1	0/1	1/1	0/1	—	—	381
Hamburg sequence, lithotectonic unit 1	2/22	22/22	13/16	4/8	3/5	2/2	1/1	0/1	—	—	—	332
Martinsburg Formation	0/6	2/6	8/5	1/3	—	—	—	—	—	—	—	175
Hershey Formation	1	1	0	2	—	—	—	—	—	—	—	167

Myerstown Formation	1/1	0/1	0/1	1/1	0/1	—	—	—	—	—	—	189
Annville Formation	0/1	1/1	1/1	0/1	1/1	—	—	—	—	—	—	220
Ontelaunee Formation	1/1	1/1	2/1	—	—	—	—	—	—	—	—	149
Epler Formation	3/9	7/9	5/8	1/4	1/2	1/2	0/1	0/1	0/1	—	—	285
Rickenbach Formation	0/2	0/2	0/2	1/2	0/1	0/1	0/1	1/1	—	—	—	390
Stonehenge Formation	0/5	4/5	1/5	2/5	1/5	1/5	4/5	1/5	0/1	0/1	1/1	540
Richland Formation	0/5	1/5	5/5	1/2	0/1	0/1	0/1	0/1	—	—	—	170
Millbach and Schaefferstown Formations, undivided	1/3	2/3	0/3	2/2	1/2	0/1	0/1	1/1	—	—	—	377
Snitz Creek Formation	2/3	2/3	2/2	3/2	0/1	1/1	0/1	—	—	—	—	290
Buffalo Springs Formation	0/5	4/5	4/5	2/4	1/4	0/4	1/2	—	—	—	—	320
Leithsville Formation	0/4	0/4	3/4	2/2	—	—	—	—	—	—	—	158
Hardyston Formation	2/2	1/2	1/2	1/2	1/2	0/1	0/1	0/1	0/1	0/1	0/1	205
Hornblende gneiss	0/5	4/5	1/5	2/3	0/2	0/2	0/2	0/2	1/2	0/2	0/2	440
Graphitic gneiss	0/1	1/1	1/1	—	—	—	—	—	—	—	—	111

[1] 0—Relative abundance of zones

—
0—Number of wells penetrating the depth range

water have not been obtained within the first 250 to 300 feet of drilling in these rocks, it is better to choose a new site rather than to further deepen the well.

Well Interference

Well interference occurs when two closely spaced wells are pumping simultaneously and the areas around the wells affected by the withdrawals overlap. Lowering of water levels and then reduction of yield usually results. The possibility of well interference should always be a consideration if a maximum sustained yield is desired. As a general rule, interference decreases as the distance between pumping wells increases. For most rock types, however, interference occurs along preferred directions. If a new high-capacity well is placed in service in the Hammer Creek Formation parallel to the strike of the beds and within 1,500 feet of another well, the yield of both wells may be significantly reduced. Wells drilled perpendicular to the strike of bedding interfere less than those parallel to it. If, however, a well drilled perpendicular to strike is close enough to intercept the same aquifers, significant interference may result. The same is generally true for the other noncarbonate rock units in the county. Interference is maximum along a line parallel to cleavage and strike of bedding. High-capacity wells located within 1,500 feet of one another will most likely interfere to some degree (Wood, 1980). In carbonate rocks, the direction of maximum interference commonly coincides with the line of solution openings, which is usually controlled by joint and fault directions. In areas of high permeability, high-capacity wells can be positioned as close as 100 feet without excessive interference. High-capacity wells should not be positioned closer than 1,000 feet in areas of moderate to low permeability (Wood and MacLachlan, 1978).

WATER–LEVEL–CONTOUR MAP

Most of the water that reaches the groundwater zone is derived from precipitation. In noncarbonate rocks, most of the precipitation infiltrates to the water table, travels a short distance downslope, and discharges to a nearby valley. The water table in noncarbonate rocks forms a subdued replica of the land surface. In carbonate rocks, however, the water table does not always follow the form of the land surface and groundwater may flow for several miles before reaching points of discharge. In these rocks, the approximate direction of groundwater flow can be determined by a water-level contour map.

A water-level map was prepared for the Lebanon Valley carbonates in October 1981 (Plate 1). To construct the map, water levels were measured in both dug and drilled wells having a wide range of depths. The resulting map

is a close approximation of the water table in the valley and serves to illustrate the general direction of groundwater flow. Groundwater flows down gradient, approximately perpendicular to the water-level contours. It should be noted that water levels may vary dramatically over relatively short distances. The contours indicate the approximate level water will rise in a well after several zones have been encountered below the water table.

In October 1981, the general direction of groundwater flow in the Lebanon Valley was northward. Groundwater movement in the western half of the valley was toward Millard quarry, near Palmyra. From Myerstown south to Schaefferstown, groundwater flow was in the direction of Tulpehocken Creek. In the small basin area south and west of Schaefferstown, groundwater movement was toward the Triassic sediments and Hammer Creek. In the remainder of the valley, the groundwater direction was northward toward Calcite quarry, east of Avon.

QUALITY OF GROUNDWATER

The chemical quality of groundwater is chiefly controlled by the composition of the soil and bedrock, and the amount of time water has been in contact with these materials (Wood, 1980). However, this natural quality can be rapidly degraded by human activities such as the disposal of industrial waste and sewage (septic tanks and cesspools), spreading of fertilizers and insecticides, and accidental gasoline and chemical spills.

Field measurements of specific conductance, hardness (as calcium carbonate), and pH are summarized in Table 5. A listing of all field measurements can be found in Table 9.

The specific conductance (an electrical measure of the mineral content in solution) multiplied by a factor of 0.6 approximately equals (in milligrams per liter) the amount of inorganic salts, organic matter, and dissolved materials (Sawyer, 1960), or total dissolved solids, present in a sample. A total dissolved-solids content greater than 500 mg/L (U.S. Environmental Protection Agency, 1975), the product of 0.6 and 833 micromhos, suggests that the sample may be polluted. Elevated median concentrations of dissolved solids occur in the carbonate-rock units throughout the valley. The greatest concentrations occur near areas of high population density and may relate to urban and industrial waste disposal practices.

Median field pH values range from 7.2 to 7.5 in carbonate-rock units and the Hammer Creek Formation (Table 5). Laboratory pH values are available for other rock units and are presented in Table 8. These values range from 5.9 to 8.5; however, most are slightly above or below 7.0. Water that has a pH below 6.0 coupled with low hardness (60 mg/L or less) can dissolve metal plumbing.

An inset map showing general patterns of groundwater hardness in the county is shown on Plate 1. Hardness measurements from studies done by

Table 5. *Summary of Field Water-Quality Measurements*

Rock unit	Number of wells	Median hardness (mg/L)	Number of wells	Median pH (units)	Number of wells	Median specific conductance (micromhos)
Diabase	5	103	2	7.0	5	250
Hammer Creek Formation	57	68	20	7.2	49	175
Sherman Creek Member of Catskill Formation	1	17	1	5.8	1	35
Trimmers Rock Formation	3	34	—	—	3	85
Mahantango Formation	1	17	1	5.8	1	35
Yellow Breeches thrust plate	10	103	—	—	14	245
Hamburg sequence, lithotectonic unit 8	21	86	13	7.3	30	220
Hamburg sequence, lithotectonic unit 6	12	86	1	6.5	13	220
Hamburg sequence, lithotectonic unit 4	6	120	—	—	7	222
Hamburg sequence, lithotectonic unit 3	12	103	4	7.1	13	198
Hamburg sequence, lithotectonic unit 2	7	171	—	—	9	380
Hamburg sequence, lithotectonic unit 1	10	137	—	—	10	284
Martinsburg Formation	2	68	—	—	2	114
Hershey Formation	15	239	22	7.2	22	570
Myerstown Formation	2	239	5	7.2	6	522
Annville Formation	5	239	8	7.4	8	565
Ontelaunee Formation	8	306	8	7.4	10	765

Epler Formation	33	291	37	7.3	45	660
Rickenbach Formation	5	239	5	7.5	13	550
Stonehenge Formation	43	239	46	7.3	52	558
Richland Formation	62	239	76	7.3	82	550
Millbach and Schaefferstown Formations, undivided	36	222	35	7.4	36	505
Snitz Creek Formation	36	274	38	7.4	43	545
Buffalo Springs Formation	39	222	41	7.4	43	550
Leithsville Formation	3	103	—	—	3	198
Hornblende gneiss	2	34	—	—	2	102
Graphitic gneiss	2	34	—	—	2	56

Meisler (1963) and Wood (1980) are also included; no corrections were made for seasonal differences or changes with time. The Lebanon Valley carbonate rocks form a prominent belt of very hard water across the county (medians for individual formations range from 222 to 306 mg/L). These limestones and dolomites are highly soluble sources of calcium and magnesium carbonate. Other areas of very hard water exist north of the valley in the interbedded limestone and shale of the Hamburg sequence.

The noncarbonate Hamburg sequence rocks yield moderately hard to hard water (medians for individual lithotectonic units range from 86 to 171 mg/L). The hard water can probably be attributed to the presence of calcareous cements and inclusions in the rocks. A zone of mixing between the hard water of Hamburg sequence unit 1 and the soft water of the ridge and valley rocks in the northern section of the county can be observed on the map along the south side of Blue Mountain. A similar zone of groundwater mixing exists in the southeast corner of the county, where the soft water from the granitic rocks of South Mountain circulates into the water of the Lebanon Valley aquifers. The normally very hard water of the dolomitic Leithsville Formation is diluted by the influx of this soft water. The median hardness reported for the Leithsville Formation is 103 mg/L.

Generally, groundwater from the Hammer Creek Formation is soft. However, an area of moderately hard water stretches across the northern border of the Triassic basin. This hardness is due to the local occurrence of carbonate-rock fragments in the Hammer Creek Formation.

Groundwater-Quality Problems

The results of 161 laboratory analyses of the major dissolved constituents in groundwater from 156 wells and five springs are reported in Table 8. Sixty-six of the analyses are from the carbonate-rock aquifers of the Lebanon Valley and 95 are from the noncarbonate-rock aquifers. Most of the analyses are summarized in Table 7, which shows the median concentrations of dissolved constituents in groundwater from selected geologic units. The source and significance of selected dissolved constituents and properties of groundwater are discussed in Table 6. No attempt was made to evaluate concentrations of organic constituents or the bacteriological quality of the water.

Maximum allowable concentrations in water from public supply wells, as defined in the National Interim Drinking Water Regulations (U.S. Environmental Protection Agency, 1975) are exceeded by one or more constituents in 71 of the 161 samples analyzed. Iron exceeded 0.3 mg/L in water from seven of 63 carbonate analyses and 29 of 92 noncarbonate analyses. Manganese concentrations exceeded 0.05 mg/L in 13 of 60 carbonate analyses and 28 of 84 noncarbonate analyses. Excessive concentrations of iron and manganese are a common problem for groundwater users in the Hamburg

Table 6. *Source and Significance of Selected Dissolved Constituents and Properties of Groundwater*[1]

(Concentrations in milligrams per liter (mg/L) except as indicated)

Constituent or property	Source or cause	Significance[2]
Silica (SiO_2)	Dissolved from practically all rocks and soils (commonly less than 30 mg/L).	Forms hard scale in pipes and boilers. When carried over in steam of high-pressure boilers it forms deposits on blades of turbines.
Aluminum (Al)	Dissolved in small quantities from aluminum-bearing rocks. Acid waters often contain large amounts.[3]	May be troublesome in feed waters because it forms scale on boiler tubes. High concentrations generally indicate the presence of acid mine drainage or industrial waste.[3] In natural water, it rarely occurs in concentrations greater than a few tenths of a milligram per liter.
Iron (Fe)	Dissolved from practically all rocks and soils. May also be derived from iron pipes, pumps, and other equipment.	On exposure to air, iron in groundwater oxidizes to a reddish-brown precipitate. More than about 0.3 mg/L stains laundry, porcelain, and utensils reddish brown. Objectionable for food processing, textile processing, beverages, ice manufacturing, brewing, and other processes. Maximum limit recommended for drinking water is 0.3 mg/L.
Manganese (Mn)	Dissolved from many rocks and soils. Often found associated with iron in natural waters, but is not as common as iron.	More than 0.2 mg/L precipitates upon oxidation. Manganese has the same undesirable characteristics as iron but is more difficult to remove. Maximum limit recommended for drinking water is 0.05 mg/L.
Cadmium (Cd)	Dissolved in small quantities from cadmium-bearing rocks. Excessive concentrations are generally the result of contamination by industrial wastes from metal-plating operations.	Concentrations above 0.01 mg/L may be toxic and are considered grounds for the rejection of a water supply.
Chromium (Cr)	Dissolved in minute quantities from chromium-bearing rocks. Excessive concentrations are generally the result of contamination by industrial wastes.	Maximum limit recommended for drinking water is 0.05 mg/L.

Table 6. *(Continued)*

Constituent or property	Source or cause	Significance[2]
Lead (Pb)	Dissolved in small quantities from lead-bearing rocks. Less than 0.01 mg/L is generally found in natural waters. Excessive concentrations are caused by contamination from such things as lead plumbing, lead picked up from the atmosphere by rain, and so forth.	Lead is accumulated by the body and causes sickness and even death in excessive concentrations. Maximum limit recommended for drinking water is 0.05 mg/L.
Zinc (Zn)	Dissolved from zinc-bearing rocks. May be dissolved from galvanized pipe and is present in many industrial wastes.	Concentrations greater than 30 mg/L have been known to cause nausea and fainting and may impart a metallic taste and milky appearance to water. Maximum limit recommended for drinking water is 5 mg/L.
Nickel (Ni)	Dissolved from nickel-bearing rocks, commonly associated with iron and manganese.	Nickel is considered to be relatively nontoxic to man.
Arsenic (As)	Dissolved in small quantities from arsenic-bearing rocks. Excessive concentrations are generally due to improper waste-disposal practices. Arsenic is also present in certain insecticides and herbicides.	Concentrations above 0.05 mg/L may be toxic and are considered grounds for rejection of a water supply. The typical concentration in groundwater is less than 0.001 mg/L.
Calcium (Ca) and magnesium (Mg)	Dissolved from practically all rocks and soils, especially from limestone, dolomite, and gypsum.	Cause of most of the hardness and, in combination with bicarbonate, is the cause of scale formation in steam boilers, water heaters, and pipes (see "Hardness"). Water low in calcium and magnesium is desired in electroplating, tanning, dyeing, and textile manufacturing.
Sodium (Na) and potassium (K)	Dissolved from practically all rocks and soils. Sewage and industrial wastes are also major sources.	Concentrations of less than 50 mg/L have little effect on the usefulness of water for most purposes. More than 50 mg/L may cause foaming in steam boilers and limit the use of water for irrigation.
Alkalinity (CO_3, HCO_3)	The bicarbonate ion may result from atmospheric carbon dioxide and the solution of carbon dioxide produced during the decomposition of organic matter in the soil. The major source, however, is from the solution of limestone.	Bicarbonate (HCO_3) and carbonate (CO_3) produce alkalinity. Bicarbonates of calcium and magnesium decompose in steam boilers and hot-water facilities to form scale and release corrosive carbon dioxide gas (see "Hardness").

Sulfate (SO_4)	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Commonly present in some industrial wastes and sewage.	Sulfates in water containing calcium may form hard calcium sulfate scale in steam boilers. Maximum limit recommended for drinking water is 250 mg/L.
Chloride (Cl)	Dissolved from rocks and soils in small quantities. Relatively large amounts are derived from sewage, industrial wastes, and highway salting practices.	In large quantities chloride increases the corrosiveness of water. Large amounts in combination with sodium will give a salty taste. Maximum limit recommended for drinking water is 250 mg/L.
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils.	About 1.0 mg/L of fluoride in drinking water is believed to be helpful in reducing the incidence of tooth decay in small children; larger concentrations cause mottling of enamel. It is recommended that fluoride not exceed 2.0 mg/L where the average daily maximum air temperature is 58.4 to 63.8 °F.
Nitrite (NO_2)	Found in sewage and other organic wastes. Unstable in the presence of oxygen, and only present in small amounts in most waters.[3]	Presence of nitrite is generally an indication of organic pollution. Undesirable in waters for some dyeing and brewing processes.[3]
Nitrate (NO_3)	Decaying organic matter, sewage, and fertilizers are principal sources.	The maximum limit recommended for drinking water is 10 mg/L of NO_3 as N. Waters containing more than this level may cause methoglobinemia (a disease often fatal in infants) and, therefore, should not be used in infant feeding. Small concentrations have no effect on usefulness of water. Most groundwaters contain less than 10 mg/L of NO_3 as N.
Ammonia nitrogen (NH_3)	Found in many waters but usually only in trace amounts. Found in waters polluted with sewage and other organic waste.[3]	Generally indicates organic pollution. Ammonium salts are destructive to concrete made from portland cement and toxic to freshwater aquatic life in concentrations in excess of 0.02 mg/L.[4]
Phosphate (PO_4)	Dissolved in very small quantities from most rocks and soils. The chief sources are fertilizer and detergents.	Concentrations much greater than local averages may indicate contamination from phosphate detergents and/or fertilizers.

Table 6. *(Continued)*

Constituent or property	Source or cause	Significance[2]
Hardness (as $CaCO_3$)	In most waters nearly all of the hardness is due to calcium and magnesium. All of the metallic cations other than the alkali metals also cause hardness. There are two classes of hardness—carbonate (temporary) and noncarbonate (permanent). Carbonate hardness refers to the hardness resulting from cations in association with carbonate and bicarbonate; it is called temporary because it may be removed by boiling the water. Noncarbonate hardness refers to that resulting from cations in association with other anions.	Hardness consumes soap before a lather will form and deposits soap curds on bathtubs. Carbonate hardness is the cause of scale formation in boilers, water heaters, radiators, and pipes, causing a decrease in heat transfer and restricted flow of water. Waters of hardness up to 60 mg/L are considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard; and more than 180 mg/L, very hard. Very soft water that has a low pH may be corrosive to plumbing. The number of milligrams per liter divided by 17.1 yields the concentration in grains per gallon.
Dissolved solids—A measure of all of the chemical constituents dissolved in a particular water. The maximum limit recommended for drinking water is 500 mg/L, but water containing up to 1,000 mg/L may be used where less mineralized supplies are not available.		
Specific conductance (micromhos at 25 °C)—A measure of the capacity of a water to conduct an electrical current. It varies with concentration and degree of ionization of the constituents. May be used to obtain a rapid estimate of the approximate dissolved-solids content of water.		
pH—The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions. Corrosiveness of water generally increases with decreasing pH. The pH of most natural waters ranges between 6 and 8.		
Temperature—The temperature of groundwater that occurs between the water table and about 60 feet below the water table is approximately the same as the average annual air temperature (Lovering and Goode, 1963, p. 5); below this point, groundwater temperatures increase with depth about 1 °F for each 50 to 100 feet.		

[1] Lloyd and Growitz (1977), p. 51–54.

[2] Recommended drinking water limits are from U.S. Environmental Protection Agency (1975, 1977).

[3] Ward and Wilmoth (1968), p. 20–22.

[4] U.S. Environmental Protection Agency (1976), p. 10.

Table 7. *Median Values of Dissolved Constituents and Properties of Groundwater for Selected Geologic Units*

(Results are in milligrams per liter except where otherwise indicated)

Geologic unit	Number of samples[1]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3 as N	NO_2 as N	NO_3 as N	Potassium (K)	Silica (SiO_2)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
Hammer Creek Formation, sandstone	7–11	6.4	—	—	34	—	—	3.8	—	122	—	64	.04	—	.01	—	—	.01	.002	.2	—	—	—	5	—
Yellow Breeches thrust plate	11–12	7.2	.0018	.06	90	<.0001	33.6	10	<.01	192	.14	104	.18	.0021	.22	7.9	.01	.06	.002	.02	.32	—	5	16	.02
Hamburg sequence, lithotectonic unit 8	6–14	6.9	.001	.07	72	<.0001	17.4	7	<.01	134	<.1	90	.16	.003	.1	5.4	<.01	.07	.01	3.5	1.06	—	6.8	10	.03
Hamburg sequence, lithotectonic unit 6	10–11	7.0	.001	.08	84	<.0001	22.6	6.6	.01	164	.13	82	.12	.0026	.03	8.2	<.01	.07	.002	.46	.84	—	9	13	.02
Hamburg sequence, lithotectonic unit 4	6	7.4	.001	.07	109	<.0001	40.8	8	<.01	152	.11	118	.24	.0034	.17	6.6	<.01	.06	.002	.04	.53	—	5.2	21	.04
Hamburg sequence, lithotectonic unit 3	7–9	7.1	.001	.05	92	<.0001	31.8	8	<.01	156	.17	104	.04	.0046	.01	7.2	.01	.06	.002	4.18	.66	—	5.3	5	.03
Hamburg sequence, lithotectonic unit 2	5–7	7.6	.0012	.05	168	<.0001	44.3	17	<.02	282	.15	166	.08	.0016	.02	7.7	.01	.06	.002	2.42	.7	—	6.5	22	.03
Hamburg sequence, lithotectonic unit 1	5–7	7.6	.001	.06	142	<.0001	44.4	6	<.01	228	.19	157	.19	.0022	.03	10	.02	.09	.002	.49	.64	—	7.4	21	.03
Ontelaunee Formation	6–9	7.3	—	—	211	—	94	26	—	394	.0	330	.12	—	.03	22	—	—	—	4	4.2	10	14	58	—
Epler Formation	5–7	7.0	—	—	222	—	102	19	—	408	.1	280	.06	—	—	18	—	—	—	6.2	5.3	10	10.9	45	—
Stonehenge Formation	8	7.4	—	—	222	—	97	10.4	—	342	.05	300	.14	—	.02	17	—	—	—	6.8	2.4	10	7.6	32	—
Richland Formation	8–10	7.3	—	—	217	—	70	6.4	—	310	0	275	.08	—	0	24	—	—	—	5.6	3.6	8.7	4.2	28	—
Snitz Creek Formation	6–8	7.6	—	—	245	—	69.1	12	—	378	.1	311	.07	—	.05	34	—	—	—	6.8	6.1	11	5.3	45	—
Buffalo Springs Formation	5–7	7.5	—	—	239	—	88	19	—	446	.1	300	.06	—	.02	26	—	—	—	6.8	3.6	12	11	45	—

[1] Number of samples varies because not all constituents were analyzed in each sample.

sequence rocks; manganese concentrations are consistently high in water samples from the Yellow Breeches thrust plate (median is 0.22 mg/L). High levels of iron and manganese, however, do not present a health hazard. The recommended limits have been set to protect the water user from the stains and precipitates that form from the relatively insoluble oxides of these constituents.

Nitrate (NO_3 as N) exceeded 10 mg/L in 10 of 64 carbonate analyses and four of 87 noncarbonate analyses. Excessive nitrate concentrations are not natural to Lebanon County, but are the long-term effects of man's activity there. Potential sources of nitrates in groundwater are crop fertilizers, cattle feedlots, barnyard wastes, and on-lot sewage-disposal systems. Excessive concentrations of nitrates may be harmful to infants and livestock if consumed on a regular basis. Prevention of nitrate pollution requires the following: (1) adequate casing of wells; (2) proper spacing between wells and septic tanks; (3) more stringent control on the installation of septic systems and design of animal feedlots; and (4) use of proper procedures in the application of fertilizers.

Other sample constituents in excess of the maximum recommended limits for drinking water include total dissolved solids, fluoride, and lead. Total dissolved solids exceeded 500 mg/L in six of 61 carbonate analyses and one of 88 noncarbonate analyses. Fluoride exceeded 2.0 mg/L in one of 77 noncarbonate analyses, and lead exceeded 0.05 mg/L in one of 62 noncarbonate analyses. Lead solder in the plumbing system is the suspected cause of the elevated lead concentration. Removal of this lead source was a suggested solution. The reported excessive concentrations of dissolved solids and fluoride are not considered to be a hazard to health.

Hydrogen sulfide taste and odors are a common problem in the Hamburg sequence rocks. Hydrogen sulfide can be encountered at depths between 100 and 150 feet where pyrite has been oxidized (FeS_2) or sulfate minerals dissolved. Concentrations of this constituent in groundwater are not known to be a health hazard.

In southern Lebanon County, diabase commonly produces poor-quality water. Groundwater circulation follows a shallow fracture system, causing drinking water supplies to be very easily contaminated by septic-tank effluent. High-density housing developments that have on-lot water and sewage will most likely experience water pollution problems in diabase. This may also be true of the metamorphic rocks in Millcreek Township.

Soft groundwater (hardness of 60 mg/L or less) that has a pH of less than 6.0 is commonly corrosive and tends to dissolve metal plumbing. This is a potential problem for all areas labeled soft on the map of water hardness (Plate 1), especially those that have a reported water hardness of 40 mg/L or less.

Groundwater quality can be seriously impaired by petroleum products. Several wells in Lebanon County have been affected by broken pipelines,

leaky fuel tanks, accidental spills, and intentional dumpage. Once a water supply is contaminated by petroleum pollution, it may remain unusable for a long period of time. A gasoline spill in the early 1930's is still affecting an area in Sinking Spring, Berks County (Wood, 1980). The taste and odor of petroleum products in a water supply can be highly objectionable. Gasoline can be detected by taste at concentrations as low as 0.005 mg/L.

Arsenic Contamination

In July 1964, arsenic pollution was discovered in groundwater at a manufacturing plant near Myerstown and in Tulpehocken Creek. During the 7-year period prior to 1964, more than 1 million pounds of inorganic and organic arsenic were placed in lagoons overlying the Epler Formation at a site about 1 mile west of Myerstown. The following discussion summarizes a U.S. Geological Survey open-file report written by C. R. Wood in 1973 concerning this problem and its effects.

From 1965 to 1971, 450,000 pounds of arsenic was recovered from the waste site; of this amount, 400,000 pounds was treated to form an insoluble arsenic compound and then stored at the plant site, and 50,000 pounds was discharged directly into Tulpehocken Creek. Augered soil samples, however, indicated that the bulk of arsenic present in the soil in 1965 had not been removed during the recovery operations. In 1973, it was estimated that 50,000 to 250,000 pounds of soluble arsenic was still tied up in the soil.

Despite large seasonal fluctuations, arsenic concentrations have steadily declined in the groundwater and in Tulpehocken Creek since 1965. Total arsenic concentrations (determined by Whitmoyer Laboratories, Inc.) in water samples taken from augered holes in similar locations were measured for 1965 and 1973. The median concentration declined from 240 mg/L in 1965 to 53 mg/L in 1973.

Figure 9 shows the range and distribution of arsenic concentrations for the Myerstown area in July 1973. The maximum allowable concentration for arsenic in water for public supply wells, 50 micrograms per liter (U.S. Environmental Protection Agency, 1975), was equaled or exceeded within the cross-hatched area of the map. All of the groundwater samples taken east of Myerstown showed little or no arsenic present. Most of the contaminant, therefore, was being discharged into Tulpehocken Creek before it reached the eastern edge of the borough.

Today, arsenic contamination is still a problem for the Myerstown vicinity (Lewis McCoy, personal communication). In the fall, arsenic usually reaches its maximum concentration in groundwater. This is probably due to the fact that not enough rainfall recharges the water table during the summer months to dilute the arsenic as it is continually being leached from the contaminated soil. The area usually affected by the arsenic stretches from the waste site west of Myerstown to the eastern edge of the borough, follow-

JACKSON
Myerstown
Tulpehocken
Weavertown
EXPLANATION
50 Spring
70 Well
Underscored number is concentration of arsenic in groundwater, in micrograms per liter, during late July 1973.
30 Gaging station
Underscored number is concentration of arsenic in Tulpehocken Creek, in micrograms per liter, on July 31, 1973
50
Line of equal arsenic concentration; 50 micrograms per liter Graundwater within cross-hatched area contains arsenic concentratians in excess of 50 micrograms per liter
Scale
1000 0 1000 2000 Ft

Figure 9. Range and distribution of arsenic concentrations in July 1973 (modified from Wood, 1973, Figure 6).

ing the permeable limestones underlying Tulpehocken Creek. A considerable reduction of arsenic concentrations most likely occurs with the dilution effects of spring recharge.

MANAGEMENT OF GROUNDWATER SUPPLIES

PROTECTION FROM OVERDRAFT

Groundwater levels are not declining anywhere in Lebanon County as a result of overpumping, other than in the areas immediately adjacent to the two major quarries identified on the water-level-contour map (Plate 1). These depressions in the water table will continue to grow as mining progresses; however, if mining ceases, groundwater levels will eventually rise to what was previously normal for the area. Elsewhere, overdraft is not a significant problem. Total water use in the county is much less than the amount of groundwater available for use.

Interference between wells that are spaced too closely, however, may be a problem. In carbonate rocks, interference usually occurs where closely spaced, high-capacity wells are in line with solution cavities, or in areas of lower-than-average permeability. High-capacity wells in noncarbonate terrain should be spaced no closer than 1,500 feet apart, especially where in line with the strike of bedding or cleavage. To compound the problem, well yields in the Hammer Creek Formation may drop to as low as one third their initial capacity during prolonged periods of heavy pumpage and low recharge. Triassic rocks have lower storage capacities than most other aquifers in the Commonwealth (Wood, 1980).

Knowledge of the preferred directions of interference and the proper spacing between wells will better assure the well owner of reliable sustained yields.

PROTECTION FROM POLLUTION

The principal groundwater contaminants identified in the noncarbonate rocks are iron and manganese. Complete removal of these contaminants or reduction in their concentration can be accomplished by a variety of apparatus, such as phosphate feeders, ion exchange units, and oxidizing filters.

The chief contaminant identified in the carbonate valley is nitrate. Potential sources are crop fertilizers, cattle feedlots, barnyard wastes, and on-lot sewage-disposal systems. Prevention of nitrate pollution requires the following: (1) adequate casing of wells; (2) proper spacing between wells and septic tanks; (3) more stringent control on the installation of septic systems and design of animal feedlots; and (4) use of proper procedures in the application of fertilizers. Water that has nitrate concentrations in excess of 10 mg/L should not be used for infant feeding.

SOURCES OF INFORMATION ABOUT WATER

A variety of information on water supplies is available from the government agencies listed below. When requesting information, it is important to give an accurate location of the site for which you wish information.

The Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey, has information on the geology of Lebanon County and has published reports that describe in detail the rocks that underlie the county. Well drillers' logs and reports on new wells that have been drilled in the county are also available at the Survey's office in Harrisburg.

The Division of Water Quality, Bureau of Water Quality Management, and the Bureau of Community Environmental Control, Pennsylvania Department of Environmental Resources, Harrisburg, can supply information on the chemical quality of groundwater, well construction requirements for public supplies and recommendations for domestic supplies, and biological reports on well water. The bureaus, through various regional offices, test water samples for bacterial pollution and advise effective corrective measures when pollution is reported.

The Bureau of Water Resources Management, Pennsylvania Department of Environmental Resources, Harrisburg, has information on stream discharges, floods, reservoir requirements, power plant discharges, and water use.

The Pennsylvania Public Utility Commission, Bureau of Rates and Research, Harrisburg, has information on some municipal water supplies, including source, average daily use, total annual use, and estimated future needs.

The U.S. Geological Survey office in Harrisburg has data on wells, springs, and streams, and on the chemical quality of water.

Local well drillers and pump installers usually can provide prices and suggest the type of equipment needed to develop a water supply. They can also suggest the proper well diameter for the necessary pumping equipment. Pump installers can supply information concerning the size of the pump, depth of the pump setting, and the pressure-tank capacity.

If the chemical analysis of the well water indicates treatment is necessary, commercial water treatment companies can provide the necessary information and equipment.

REFERENCES

Becher, A. E. (1971), *Ground water in Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Educational Series 3, 2nd ed., revised, 42 p.

_____ (1981), *Groundwater resources of anthracite areas in and near Schuylkill County, Pennsylvania* (unpublished).

Berg, T. M., Edmunds, W. E., Geyer, A. R., and others (1980), *Geologic map of Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Map 1, scale 1:250,000, 3 sheets.

Biesecker, J. E., Lescinsky, J. B., and Wood, C. R. (1968), *Water resources of the Schuylkill River basin*, Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 3, 198 p.

Carswell, L. D., Hollowell, J. R., and Platt, L. B. (1968), *Geology and hydrology of the Martinsburg Formation in Dauphin County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 24, 54 p.

Geyer, A. R. (1970), *Geology, mineral resources and environmental geology of the Palmyra quadrangle, Lebanon and Dauphin Counties*, Pennsylvania Geological Survey, 4th ser., Atlas 157d, 46 p.

Geyer, A. R., Buckwalter, T. V., McLaughlin, D. B., and Gray, Carlyle (1963), *Geology and mineral resources of the Womelsdorf quadrangle*, Pennsylvania Geological Survey, 4th ser., Atlas 177c, 96 p.

Geyer, A. R., Gray, Carlyle, McLaughlin, D. B., and Moseley, J. R. (1958), *Geology of the Lebanon quadrangle*, Pennsylvania Geological Survey, 4th ser., Atlas 167c, scale 1:24,000.

Gray, Carlyle, Geyer, A. R., and McLaughlin, D. B. (1958), *Geology of the Richland quadrangle*, Pennsylvania Geological Survey, 4th ser., Atlas 167d, scale 1:24,000.

Gray, Carlyle, Moseley, J. R., McLaughlin, D. B., and others (1954), *Guidebook—20th Annual Field Conference of Pennsylvania Geologists*, Annual Field Conference of Pennsylvania Geologists, 20th, Hershey, Pa., 1954, Guidebook, 44 p.

Hall, G. M. (1934), *Groundwater in southeastern Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 2, 255 p.

Hem, J. D. (1970), *Study and interpretation of the chemical characteristics of natural water*, U.S. Geological Survey Water-Supply Paper 1473, 2nd ed., 363 p.

Johnston, H. E. (1966), *Hydrology of the New Oxford Formation in Lancaster County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 23, 80 p.

Landers, R. A. (1976), *A practical handbook for individual water-supply systems in West Virginia*, West Virginia Geological and Economic Survey Educational Series, 102 p.

Lloyd, O. B., Jr., and Growitz, D. J. (1977), *Ground-water resources of central and southern York County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 42, 93 p.

Lovering, T. S., and Goode, H. D. (1963), *Measuring geothermal gradients in drill holes less than 60 feet deep, East Tintic district, Utah*, U.S. Geological Survey Bulletin 1172, 48 p.

Meisler, Harold (1963), *Hydrogeology of the carbonate rocks of the Lebanon Valley, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 18, 81 p.

Pennsylvania Department of Environmental Resources, Bureau of Resources Programming (1980), *The State Water Plan—Subbasin 7, Lower Susquehanna River*, Bulletin SWP-8, 294 p.

Poth, C. W. (1973), *Hydrology of the metamorphic and igneous rocks of central Chester County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 25, 84 p.

Sawyer, C. N. (1960), *Chemistry for sanitary engineers*, New York, McGraw-Hill Book Co.

Stuart, W. T., Schneider, W. J., and Crooks, J. W. (1967), *Swatara Creek basin of southeastern Pennsylvania—An evaluation of its hydrologic system*, U.S. Geological Survey Water-Supply Paper 1829, 79 p.

Taylor, L. E., and Royer, D. W. (1981), *Summary groundwater resources of Adams County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 52, 50 p.

Taylor, L. E., and Werkheiser, W. H. (in press), *Groundwater resources of the Lower Susquehanna River basin, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 57.

U.S. Environmental Protection Agency (1974), *Manual of individual water supply systems*, Office of Water Programs, Water Supply Division, U.S. Government Printing Office, 155 p.

_____ (1975), *National interim primary drinking water regulations*, Federal Register, v. 40, no. 248, December 24, 1975, p. 59566–59588.

_____ (1976), *Quality criteria for water*, U.S. Government Printing Office, 256 p.

_____ (1977), *National secondary drinking water regulations*, Federal Register, v. 42, no. 62, March 31, 1977, p. 17143–17147.

U.S. Weather Bureau (issued annually), Local climatological data, Harrisburg, Pennsylvania.

Ward, P. E., and Wilmoth, B. M. (1968), *Ground-water hydrology of the Monongahela River basin in West Virginia*, West Virginia Geological and Economic Survey River Basin Bulletin 1, 54 p.

Wood, C. R. (1973), *Evaluation of arsenic concentrations in the Tulpehocken Creek basin, Pennsylvania*, U.S. Geological Survey Open-File Report, 16 p.

_____ (1980), *Groundwater resources of the Gettysburg and Hammer Creek Formations, southeastern Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 49, 87 p.

Wood, C. R., Flippo, H. N., Jr., Lescinsky, J. B., and Barker, J. L. (1972), *Water resources of Lehigh County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 31, 263 p.

Wood, C. R., and MacLachlan, D. B. (1978), *Geology and groundwater resources of northern Berks County, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 44, 91 p.

Wood, G. H., Jr. (1968), *Geologic map of the Tower City quadrangle, Schuylkill, Dauphin, and Lebanon Counties, Pennsylvania*, U.S. Geological Survey Geologic Quadrangle Map GQ–698, scale 1:24,000.

Wood, G. H., Jr., and Kehn, T. M. (1968), *Geologic map of the Pine Grove quadrangle, Schuylkill, Lebanon, and Berks Counties, Pennsylvania*, U.S. Geological Survey Geologic Quadrangle Map GQ–691, scale 1:24,000.

Wood, G. H., Jr., Trexler, J. P., and Kehn, T. M. (1969), *Geology of the west-central part of the Southern Anthracite field and adjoining areas, Pennsylvania*, U.S. Geological Survey Professional Paper 602, 150 p.

GLOSSARY

Aquifer. A formation that yields significant quantities of water to wells and springs.

Baseflow. Discharge entering stream channels as flow from the groundwater reservoir; the fair-weather flow of streams.

Carbonate rocks. Rocks composed dominantly of carbonate minerals. Limestone and dolomite are the most common rocks of this type.

Dip of bed. The angle at which the bed is inclined from the horizontal, measured at a right angle to the strike or trend of the bed.

Discharge, groundwater. The process by which water is removed from the saturated zone; also the quantity of water removed.

Drawdown. The lowering of the water level in a well caused by pumping.

Evapotranspiration. Water withdrawn from a land area by direct evaporation from water surfaces and moist soil, and by plant transpiration.

Fault. A fracture or fracture zone along which there has been displacement of the two sides relative to each other. The displacement may be a few inches or many miles.

Formation. A fundamental unit in rock-stratigraphic classification. It is a tabular body of rock characterized by uniform rock properties; it is mappable at the earth's surface or traceable in the subsurface.

Fracture. A break in the rock.

Groundwater reservoir. An aquifer or a group of related aquifers underlying a given area.

Group. A stratigraphic unit consisting of two or more formations.

Hardness. A chemical property of water, caused mostly by the presence of calcium and magnesium, which increases the amount of soap needed to produce a lather. Water that has a hardness, calculated as grains per gallon of calcium carbonate, less than 3.5 is soft; between 3.5 and 7.0 is moderately hard; between 7.1 and 10.5 is hard; and greater than 10.5 is very hard. Values may be converted to milligrams per liter by multiplying by 17. Hardness values used in this report were determined in the field by use of a Calgon Speedy kit for testing water hardness. (Use of a brand name is for identification purposes only and does not imply endorsement by the Pennsylvania Geological Survey.)

Igneous rock. A rock that solidified from molten material.

Lithology. The physical character of a rock.

Metamorphic rock. A rock derived from preexisting rocks by change in mineral composition or texture caused by heat and/or pressure.

Overdraft. An excessive lowering of the water level or artesian head in an aquifer caused by excessive withdrawal.

Permeability. The capacity of a material to transmit a fluid.

pH. The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions.

Porosity. The ratio of the volume of openings in a rock to its total volume, expressed as a percentage.

Primary openings. Openings or voids existing when the rock was formed. In sedimentary rocks, openings result from the shape and nature of the original sediment and the way the particles are fitted together.

Recharge, groundwater. The process by which water is added to the saturated zone; also the quantity of water added.

Runoff. The part of precipitation that appears in streams. It is the same as streamflow unaffected by diversions, dams, or other works of man.

Saturated zone. The zone in which interconnected openings are saturated with water.

Secondary openings. Voids produced by solution, weathering, or fracturing after the rocks were formed.

Specific capacity. The yield of a well, in gallons per minute, divided by the drawdown of water level in the well, in feet.

Specific conductance. A measure of the capacity of water to conduct an electrical current. It varies with concentration and degree of ionization of the constituents.

Stream-gaging station. A gaging station where a record of discharge of a stream is obtained. Within the U.S. Geological Survey this term is used only for those gaging stations where a continuous record of discharge is obtained.

Surface water. Water on the surface of the earth.

Transpiration. The process by which vapor escapes from the living plant, principally the leaves, and enters the atmosphere.

Water table. The upper surface of the zone of saturation, or that zone in which openings in permeable rocks are filled with water.

TABLE 8. CHEMICAL ANALYSES OF GROUNDWATER

(Results are in milligrams per liter except where otherwise indicated)

Well number	Date of collection	Data source[a]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Silica (SiO_2)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
DIABASE																										
Lb- 206	10-13-59	W	6.7	---	---	83	---	33	7.2	---	199	.1	120	.41	---	.03	9.9	---	---	---	2.7	.7	42	9.2	35	---
230	10-12-59	U	6.5	---	---	78	---	71	39	---	446	.1	290	.06	---	0	28	---	---	---	33	.8	36	14	64	---
HAMMER CREEK FORMATION																										
412	4-23-81	O	6.7	---	---	86	---	---	8	---	274	---	134	.06	---	.02	---	---	.01	.002	3.52	---	---	---	15	---
432[b]	2-19-81	O	6.4	---	---	20	---	---	5	---	50	---	30	.07	---	.01	---	---	.01	.002	.01	---	---	---	<5	---
434[b]	4-20-81	O	5.9	---	---	15	---	---	1	---	58	---	<20	.02	---	.01	---	---	<.01	<.002	.02	---	---	---	<5	---
615	10-16-59	U	6.7	---	---	95	---	38	3.4	---	146	.0	110	.48	---	0	4.5	---	---	---	.05	.8	18	3.2	20	---
720[b]	1-9-63	U	7.0	---	---	123	---	42	2.6	---	172	.0	110	.14	---	0	1.7	---	---	---	.72	1.5	40	6.7	0	---
788	4-23-81	O	6.9	---	---	104	---	---	8	---	258	---	154	.05	---	.01	---	---	.01	.002	4.2	---	---	---	15	---
793[b]	4-20-81	O	5.9	---	---	11	---	---	2	---	22	---	<20	.01	---	.04	---	---	<.01	<.002	.04	---	---	---	<5	---
794[b]	4-20-81	O	6.1	---	---	34	---	---	21	---	114	---	45	.02	---	.01	---	---	<.01	<.002	.18	---	---	---	<5	---
795	6-2-76	U	6.0	<.001	.01	13	.001	3.5	2.9	.01	35	.0	14	.13	.005	0	1.3	---	.01	.01	.05	.7	14	2.1	2.2	.04
796[b]	5-29-81	O	6.0	---	---	30	---	---	45	---	196	---	73	.03	---	.02	---	---	.01	.002	.22	---	---	---	10	---
797[b]	3-13-74	U	6.3	---	---	25	---	---	3	---	---	.1	41	<.01	---	<.01	---	---	---	---	.14	---	---	---	21	---
798[b]	5-13-76	U	6.8	.001	.01	66	0	20	1.5	.01	111	.1	69	.04	.002	<.01	4.6	---	.02	.01	1.1	.8	23	5.6	11	.01
799[b]	5-28-81	O	6.4	.01	---	112	.001	---	5	.01	268	.1	140	.22	.01	.01	---	---	.01	.002	7.7	---	---	---	5	---
1092[b]	2-9-81	C	7.8	---	---	87	---	38	3.8	---	219	---	120	1.25	---	---	7	---	---	---	---	---	---	---	5.2	---
1096[b]	10-7-81	O	6.4	.001	.09	52	<.0001	17.6	6	<.01	130	.6	64	1.05	.001	.02	3.8	.02	.06	.002	1.44	.64	---	1.1	5	.03
Sp-64	8-13-81	O	7.4	<.005	.04	200	<.0005	100	22	<.01	464	.12	346	.11	<.005	<.01	4.6	<.01	.07	.002	16.38	.6	---	7.3	14	.04
SHERMAN CREEK MEMBER OF CATSKILL FORMATION																										
1057	9-23-81	O	6.5	.0014	.05	34	<.0001	6.2	2	.02	62	<.1	40	.85	.0012	.02	3.4	<.01	.01	.002	.02	.48	---	2.6	2	.04
TRIMMERS ROCK FORMATION																										
1059	9-23-81	O	6.7	.0016	.06	58	<.0001	17.8	6	.01	72	.95	61	.05	.0022	.02	4.4	<.01	.01	.002	1.2	.26	---	3.7	4	.02
1069	9-24-81	O	6.5	.001	.03	40	<.0001	6.1	2	.01	186	.16	30	1.51	.0017	.03	4.3	<.01	.01	.002	.3	.34	---	5.2	<5	.03
1080	10-7-81	O	6.4	.001	.09	28	<.0001	7.2	3	<.01	68	.12	30	.08	<.001	.02	2.8	.01	.06	.002	1.28	.38	---	4.6	10	.04
MAHANTANGO FORMATION																										
718	1-8-63	U	6.2	---	---	11	---	2.4	.8	---	27	.1	8	.12	---	0	.5	---	---	---	.77	.8	9	3.1	0	---
YELLOW BREECHES THRUST PLATE																										
963	7-23-81	O	7.1	.0016	.09	84	<.0001	26.1	10	.01	182	<.1	101	1.53	.0014	.68	9.3	<.01	.1	.002	.02	.42	---	6.2	20	.05
967	7-29-81	O	6.7	.0018	.05	60	<.0001	12.8	4	<.01	90	.14	68	1.1	.0029	2.24	9	.01	.13	.004	.02	.42	---	3	5	.04
968	8-12-81	O	7.1	.0016	.12	110	.0001	37.5	11	<.01	202	.14	---	.37	.0036	.9	8.7	.01	---	.002	1.14	.34	---	2.1	6	.04
970	7-29-81	O	7.6	.001	.05	96	<.0001	54.4	50	<.01	310	.14	181	.08	.0033	.1	10.5	.01	.06	.002	.02	.01	---	8.9	30	.02
971	7-29-81	O	7.8	.0022	.07	102	<.0001	38.9	50	<.01	264	.1	150	.16	.002	.23	10.9	<.01	.1	.002	.02	.06	---	18.2	5	.02
973	7-29-81	O	7.1	.0023	.06	64	<.0001	33.6	6	<.01	200	<.1	123	.14	.001	.01	7.7	.01	.05	.014	3.73	.32	---	5.2	40	.02
976	7-30-81	O	7.6	.0019	.05	110	<.0001	45.2	3	.02	184	.12	131	.09	.0016	.09	4.7	.04	.05	.004	.02	.22	---	3.3	20	.02
978	7-30-81	O	7.5	.0027	.05	80	<.0001	42.9	10	<.01	230	.13	138	.06	.0021	.21	7.1	.02	.05	.032	.35	.26	---	4.8	45	.03
979	7-30-81	O	7.3	.002	.07	74	<.0001	31.4	4	<.01	134	.14	104	.21	.0069	.18	5.2	.02	.05	.002	.02	.16	---	4.8	25	.02

983	7-30-81	D	7.8	.0029	.02	104	<.0001	14.9	2	<.01	110	<.1	62	.23	.0021	.01	4.2	.02	.05	.002	.52	.38	---	22.8	<5	.02
1014	8-19-81	D	6.7	.001	.07	62	.0002	18.7	10	.03	134	.26	98	.08	.0063	.23	8.1	.02	.17	.014	3.73	.32	---	2.5	8	.35
1067	9-24-81	D	6.8	.001	.06	138	<.0001	29.3	12	.01	200	.22	88	2.29	.0017	.65	5.1	<.01	.17	.002	.02	.58	---	30.6	12	.02
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 8																										
24	9-15-25	U	---	---	---	104	---	39	24	---	192	---	140	.05	---	---	10	---	---	---	3.2	1.7	17	11	13	---
259	10-13-59	U	6.6	---	---	41	---	18	10	---	126	.0	64	.08	---	0	4.6	---	---	---	5.6	1	22	9	12	---
281	10-13-59	U	7.5	---	---	172	---	57	1.8	---	239	.0	200	.15	---	.03	14	---	---	---	.05	1	20	6.8	35	---
298	10-19-59	U	7.3	---	---	59	---	25	4	---	134	.0	97	.06	---	0	8.5	---	---	---	9.7	.8	8.6	3.2	5.9	---
705	3-30-77	O	7.6	---	---	94	---	---	10	---	---	---	108	.07	---	---	---	---	.11	.032	3.71	---	---	4	---	---
913	7-9-81	O	6.3	.001	.06	24	.0002	5.2	4	.01	122	<.1	34	1.63	.008	.07	4.6	<.01	.06	.002	6.6	1.26	---	9	10	.2
914	7-9-81	D	6.7	.001	.08	60	.0003	12.9	2	<.01	114	.17	49	1.99	.009	1.07	3.7	.01	.06	.002	.02	.86	---	5.9	5	.02
915	7-9-81	D	7.5	.001	.07	78	<.0001	16.9	2	<.01	148	.3	54	.07	.0017	.14	5	<.01	.06	.002	.02	1.3	---	7.8	10	.02
918	7-8-81	D	7.1	.0002	.07	98	<.0001	23.8	2	.01	158	.12	83	.89	.0042	.76	5.8	.01	.08	.01	.01	.96	---	7.4	10	.02
921	7-8-81	D	6.4	.001	.12	42	<.0001	5.5	6	<.01	118	<.1	40	8.91	.0012	1.73	5.1	.01	.11	.002	.02	1.76	---	6.7	15	.05
994	8-12-81	D	6.9	.001	.04	44	.0001	7.3	8	<.01	92	.3	52	.41	.0019	1.19	7.8	<.01	.08	.01	.15	1.12	---	.8	5	.04
1104	8-11-75	D	6.8	---	---	114	---	---	30	---	---	---	198	.2	---	---	---	---	.02	.44	4.94	---	---	---	---	---
1105	8-11-75	D	6.5	---	---	66	---	---	20	---	---	---	165	.03	---	---	---	---	.02	.05	5.5	---	---	---	---	---
1107	3-29-76	D	7.7	---	---	136	---	---	14	---	222	.06	162	.16	---	.03	---	---	.17	.015	4.99	---	---	---	12.5	---
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 6																										
719	1-9-63	U	6.8	---	---	46	---	13	6.6	---	100	.1	58	.54	---	0	6.3	---	---	---	2.5	.5	13	9	12	---
903	7-23-81	D	6.8	.001	.08	122	<.0001	38	17	.01	260	<.1	163	2.45	.0047	.04	19.9	.02	.1	.002	1.24	.42	---	5.2	28	.02
923	7-8-81	D	8.0	.001	.04	130	<.0001	24.5	2	<.01	176	.16	97	.11	.0011	.06	9.9	.01	.12	.002	.02	.96	---	16.7	15	.02
924	7-8-81	O	8.5	<.005	.04	102	.001	17.5	2	<.01	168	.16	45	.33	.48	.03	3.3	.01	.13	.002	.02	1.84	---	24.3	10	.14
944	7-15-81	O	7.5	.0011	.13	116	<.0001	32.1	1	<.01	164	<.1	112	.12	.0005	.11	8.4	<.01	.03	.004	.08	.84	---	2.5	21	.01
948	7-15-81	O	7.0	.001	.18	74	<.0001	17.3	18	<.01	154	.13	76	.07	.0028	.01	8.2	<.01	<.01	<.002	1.36	.92	---	9.8	18	.05
957	7-23-81	O	8.0	.0014	.08	84	<.0001	18.1	3	.01	118	.16	68	.2	.0025	.03	6.4	<.01	.07	.028	.43	.98	---	9.7	8	.03
966	7-23-81	D	6.9	.0015	.08	70	<.0001	22.8	14	.04	168	.12	82	2.26	.0073	1.83	7.1	.03	.07	.002	.02	.7	---	8.6	13	.02
1074	9-24-81	D	7.3	.001	.04	92	<.0001	24.9	8	.01	144	.2	83	.07	.0017	.01	6.5	<.01	.01	.002	.46	.62	---	7.4	4	.02
1078	9-24-81	D	6.6	.001	.07	72	<.0001	16.8	6	.01	94	.14	74	.06	.001	.02	8.8	<.01	.01	.002	.72	.6	---	5.5	6	.02
Sp-63	7-23-81	D	5.7	<.005	.07	11	<.0005	22.6	25	.01	268	<.1	96	.03	<.005	.02	9.6	.01	.07	.002	13.64	1.68	---	9.7	36	.02
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 4																										
940	7-15-81	D	6.7	.001	.05	60	<.0001	19.3	14	<.01	154	.1	77	2.12	.0019	1.28	6.1	<.01	.02	.002	.02	.36	---	4.9	22	.04
950	7-15-81	O	7.3	.0054	.07	84	<.0001	24.6	9	<.01	150	<.1	83	.79	.0054	.44	6	<.01	.07	<.002	.06	.44	---	5.3	20	.03
951	7-15-81	D	7.2	.001	.16	80	<.0001	16.4	3	<.01	120	.115	65	.4	.0025	.3	7	<.01	.02	<.002	<.02	.35	---	6.1	17	.01
960	7-23-81	D	7.5	.0011	.07	134	<.0001	56.9	7	.01	220	<.1	154	.03	.0042	.03	7.3	.02	.07	.002	3.74	.84	---	5.2	14	.02
965	7-23-81	D	7.6	.0025	.05	142	<.0001	73.4	4	.01	148	.14	175	.01	.0019	.04	3.7	.01	.09	.002	.02	.62	---	3.8	39	.04
1016	8-20-81	D	7.4	.001	.09	204	<.0001	128	112	.01	706	.17	366	.09	.0043	.02	10.9	.02	.06	.004	5.28	.7	---	9.1	35	.05
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 3																										
443	3-11-81	D	7.1	---	---	106	---	---	26	---	268	---	168	.01	---	.01	---	---	.01	.002	7.7	---	---	---	25	---
444	4-26-61	D	7.1	---	---	82	---	33.6	3.5	---	133	---	98	.03	---	---	3.4	---	---	---	9.7	---	13.4	5.3	14	---
962	7-23-81	D	6.8	.0013	.05	50	<.0001	15	6	.01	148	<.1	64	<.01	.0054	.02	6.8	.01	.08	.002	4.18	.78	---	7.7	5	.07
990	8-12-81	O	7.9	.0023	.06	92	<.0001	44.1	10	<.01	216	.17	144	.04	.0015	.01	7.5	.01	.06	.002	.4	.2	---	5.4	51	.03
993	8-12-81	O	7.7	.0013	.04	90	<.0001	30.1	5	<.01	156	.2	104	.1	.0036	.01	8	.01	.06	.002	4.4	.66	---	3.5	<5	.03
1007	8-19-81	D	6.7	.001	.08	54	.0004	24.8	20	<.01	138	.23	80	1.1	.0051	1.58	4.2	.04	.08	.002	.02	.48	---	.9	<5	1.98
1013	8-19-81	D	7.6	.001	.1	136	.0001	36	3	<.01	184	.31	129	.04	.0063	.01	9.3	.05	.11	.042	.21	1.16	---	7.3	<5	.1
1064	9-23-81	D	7.1	.001	.04	162	.0002	77.5	20	<.01	302	.11	286	.06	.0046	.01	8.1	.01	.01	.002	5.74	.76	---	5.3	22	.02
1065	9-23-81	D	6.9	.001	.05	92	<.0001	28.2	8	<.01	102	.16	87	.18	.001	.43	6.5	.01	.01	.002	.02	.34	---	4.6	2	.02
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 2																										
727	3-27-59	U	7.6	---	---	197	---	96	17	---	354	.0	290	.03	---	.17	11	---	---	---	1.7	1	19	12	72	---
954	7-16-81	D	7.5	.001	.19	168	<.0001	85.6	8	<.03	360	<.1	274	.04	.0067	.02	7.7	.03	.04	<.002	12.98	.48	---	3.4	45	.03
986	8-12-81	O	8.2	.001	.03	220	.0001	29.3	18	.02	282	.75	98	.05	.001	.02	10.6	.03	.22	.002	.02	1.36	---	68.5	22	.17
987	8-12-81	O	7.8	.002	.02	148	.0002	42.9	4	<.01	228	.29	166	.08	.0013	.01	14.9	.01	.06	.002	2.20	.7	---	6.5	17	.03
997	8-12-81	D	7.6	.0013	.11	88	<.0001	38.1	18	<.01	210	.15	130	.14	.0016	.01	6.4	<.01	.06	.002	3.30	.46	---	2.9	14	.03
1063	9-23-81	D	7.0	.001	.05	92	<.0001	44.3	5	.01	156	.15	115	.33	.0018	.01	3.3	<.01	.01	.002	2.42	.52	---	3.9	20	.02
1101	3-2-75	C	7.2	<.01	---	189	---	110	34	<.05	473	---	302	.11	---	.23	6.9	---	---	---	6.73	1.89	---	14.1	36	---

TABLE 8. (CONTINUED)

Well number	Date of collection	Data source	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Silica (SiO_2)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
HAMBURG SEQUENCE, LITHOTECTONIC UNIT 1																										
728	3-26-59	U	6.9	---	---	90	---	43	8.6	---	217	.2	150	.38	---	.06	10	---	---	---	6.3	4.9	16	10	42	---
1003	8-13-81	O	7.7	.001	.05	142	<.0001	44.4	2	<.01	184	.12	142	.18	.0031	.13	6.6	<.01	.09	.002	.02	.5	---	3.4	8	.04
1009	8-19-81	O	7.7	.0025	.1	192	<.0001	48	7	.01	242	.19	182	.03	.001	.03	18	.04	.12	.006	.49	.84	---	11.6	10	.03
1011	8-19-81	O	7.5	.001	.09	180	.0002	50.7	4	.01	252	.1	190	.6	.0013	.04	10.6	.04	.09	.002	.02	.54	---	7.4	22	---
1018	8-20-81	O	7.4	.001	.08	102	<.0001	42.4	6	<.01	200	.17	134	.24	.001	.01	6.7	.01	.06	.002	.5	.44	---	3	21	.05
1035	9-2-81	O	7.7	.0032	.03	128	<.0001	40.5	3	<.01	228	.33	157	.14	.0069	.01	13.6	.02	.06	.002	1.84	.66	---	3.3	15	.03
1036	9-2-81	O	7.6	.0053	.04	188	<.0001	74	9	<.01	284	.56	190	.05	.0036	.01	9.9	.02	.1	.008	.19	.64	---	10.4	25	.01
MARTINSBURG FORMATION																										
1024	8-20-81	O	7.1	.001	.32	88	.0001	23.2	6	<.01	142	.24	87	.76	.0026	.27	7.2	<.01	.05	.002	.06	.86	---	8.3	8	.04
HERSHEY FORMATION																										
317	10-13-59	U	7.1	---	---	210	---	96	8.8	---	328	.0	280	.06	---	.02	9.6	---	---	---	3.4	3.8	9.4	7	52	---
587	10-19-59	U	7.2	---	---	195	---	103	7.4	---	340	.0	290	.04	---	0	6.9	---	---	---	7.9	1.5	8.2	5	56	---
654	10-19-59	U	7.4	---	---	247	---	112	10	---	389	.1	330	.11	---	.19	12	---	---	---	8.1	3.8	10	7.1	50	---
Sp-59	10-19-59	U	7.2	---	---	226	---	116	8	---	374	.0	320	.05	---	.2	7.4	---	---	---	4.3	1.5	11	5.3	70	---
ANNVILLE FORMATION																										
381	10-19-59	U	7.3	---	---	218	---	75	15	---	297	.0	270	.08	---	0	19	---	---	---	1.6	2.6	9	9	29	---
ONTELAUNEE FORMATION																										
12	10-1-25	U	---	---	---	189	---	58	8	---	---	---	210	.06	---	---	16	---	---	---	1.1	---	12	---	16	---
23	10-2-25	U	---	---	---	211	---	100	44	---	---	---	330	.12	---	---	20	---	---	---	0	---	32	---	116	---
275	2-13-59	U	7.6	---	---	248	---	78	14	---	394	.0	330	.37	---	.03	32	---	---	---	8.6	1.8	5.9	17	58	---
324	10-13-59	U	7.2	---	---	408	---	135	52	---	768	.0	560	.04	---	0	55	---	---	---	34	13	9	47	61	---
366	2-13-59	U	7.4	---	---	189	---	88	9	---	326	.0	270	.11	---	0	11	---	---	---	1.2	1.1	16	9.9	72	---
635	10-19-59	U	7.0	---	---	286	---	104	26	---	414	.0	350	.13	---	0	23	---	---	---	1.9	5.5	10	12	53	---
685	10-19-59	U	7.4	---	---	206	---	80	14	---	328	.0	280	.02	---	.06	19	---	---	---	4.5	2.9	8.6	10	50	---
704	11-12-81	O	7.3	.005	---	202	.0002	---	28	.01	366	.1	240	.14	<.005	.04	---	.02	.01	.002	3.96	---	---	---	15	.03
732	8-1-73	U	7.2	20	---	387	---	160	160	---	837	.3	530	4.1	---	.4	32	---	23	.045	.01	23	11	64	88	---
EPLER FORMATION																										
21	10-2-25	U	---	---	---	206	---	76	22	---	---	---	260	.06	---	---	18	---	---	---	5.9	---	15	---	49	---
322	10-19-59	U	7.0	---	---	341	---	126	27	---	498	.0	400	.01	---	0	20	---	---	---	5.6	5.3	13	25	52	---
333	10-21-59	U	6.9	---	---	282	---	118	11	---	419	.1	370	.02	---	0	17	---	---	---	7.9	8.2	7.9	7.6	45	---
591	10-21-59	U	7.4	---	---	174	---	99	19	---	398	.1	280	.7	---	.03	7.8	---	---	---	21	3.8	4.9	20	45	---
663	10-12-59	U	6.8	---	---	251	---	104	8.6	---	349	.2	310	.06	---	0	13	---	---	---	3.4	8	10	4	35	---
1054	7-12-73	O	7.0	---	---	214	---	---	12	---	372	---	258	.09	---	.04	---	---	.05	.008	7.8	---	---	---	36	---
Sp-18	9-1-81	O	7.4	<.005	.05	222	<.0005	95.7	21	.02	424	.44	258	.04	.005	.01	19.5	.03	.06	.002	6.16	3.58	---	10.9	55	.01
RICKENBACH FORMATION																										
553	10-21-59	U	7.5	---	---	201	---	81	6.1	---	291	.1	260	.14	---	0	14	---	---	---	5	2	9.6	3.8	32	---
580	10-19-59	U	7.2	---	---	245	---	77	8.4	---	330	.0	300	.11	---	.03	27	---	---	---	2.9	3	7.4	5.7	41	---
621	10-16-59	U	7.7	---	---	195	---	54	4.4	---	273	.3	250	.04	---	0	28	---	---	---	1.6	2	9.8	4	46	---

STONEHENGE FORMATION																									
50	10-12-59	U	7.4	---	---	224	---	80	11	---	318	.0	270	.48	---	0	16	---	---	---	8.4	1.9	11	9	17	---
59	10-12-59	U	7.4	---	---	224	---	120	55	---	438	.1	340	.14	---	.06	10	---	---	---	16	1.9	10	19	16	---
92	2-13-59	U	7.6	---	---	211	---	92	8.4	---	361	.0	310	1.1	---	.08	20	---	---	---	5.2	5	10	6.2	69	---
111	10-12-59	U	7.3	---	---	220	---	102	9.8	---	323	.1	290	0	---	0	7.4	---	---	---	4.3	1.4	8.6	4.3	38	---
148	2-13-59	U	7.4	---	---	179	---	72	6.8	---	297	.0	250	.09	---	0	17	---	---	---	5	2.8	13	5.2	51	---
229	10-16-59	U	8.2	---	---	177	---	62	5.7	---	250	.1	230	.14	---	.02	17	---	---	---	4.7	1.8	10	3.3	23	---
526	10-19-59	U	7.0	---	---	320	---	106	61	---	640	.1	430	.05	---	.19	41	---	---	---	30	42	12	26	27	---
546	10-16-59	U	6.9	---	---	379	---	131	59	---	762	.0	550	.16	---	.03	54	---	---	---	41	19	9.4	40	40	---
RICHLAND FORMATION																									
29	10-2-25	U	---	---	---	182	---	44	1	---	---	---	200	.13	---	---	22	---	---	---	.09	---	9.7	---	20	---
68	10-12-59	U	7.2	---	---	221	---	64	6.8	---	310	.4	290	.04	---	0	32	---	---	---	1.3	1.8	10	4	52	---
140	10-21-59	U	7.2	---	---	245	---	92	82	---	619	.0	340	.05	---	0	26	---	---	---	24	7.3	13	84	61	---
217	10-13-59	U	7.5	---	---	197	---	75	6.0	---	297	.2	250	.11	---	.06	15	---	---	---	5.2	4.6	7.2	7.1	40	---
344	10-16-59	U	7.6	---	---	256	---	86	8.1	---	355	.0	320	.04	---	.03	25	---	---	---	7.9	7.2	8.6	3.3	28	---
513	10-16-59	U	7.9	---	---	174	---	52	6	---	252	.1	230	.1	---	.01	24	---	---	---	4.7	1.5	5.6	3.3	34	---
532	10-21-59	U	7.4	---	---	213	---	69	5	---	280	.0	260	.16	---	0	20	---	---	---	5.2	2.1	8.8	4.3	20	---
538	10-16-59	U	7.3	---	---	238	---	70	11	---	355	.0	320	.27	---	0	35	---	---	---	14	2.6	8.2	3.2	20	---
606	10-16-59	U	7.2	---	---	241	---	93	22	---	400	.0	320	.07	---	0	21	---	---	---	18	6	11	14	16	---
1025	5-2-67	O	7.2	---	---	179	---	---	5	---	292	.0	214	0	---	---	---	---	---	.004	.004	6	---	---	---	---
MILLBACH FORMATION																									
153	10-12-59	U	7.3	---	---	190	---	71	8.4	---	286	.2	240	0	---	0	15	---	---	---	4.7	5	11	6.4	34	---
238	10-12-59	U	8.1	---	---	186	---	70	6.2	---	265	.2	220	.05	---	.05	11	---	---	---	5.6	2.4	11	3.7	24	---
579	10-16-59	U	7.9	---	---	194	---	74	4.2	---	276	.1	250	.05	---	.03	15	---	---	---	5.9	1.2	9.8	3.3	26	---
598	10-16-59	U	7.7	---	---	171	---	61	7.3	---	261	.2	210	.07	---	.03	15	---	---	---	5	4.1	4.9	8.3	36	---
1102	2-23-66	O	7.4	---	---	237	---	---	7	---	380	---	262	---	---	---	---	---	---	.002	---	.3	---	---	---	---
SCHAEFFERSTOWN FORMATION																									
40	10-12-59	U	7.3	---	---	190	---	68	6.2	---	279	.1	240	.11	---	---	18	---	---	---	6.6	1.9	13	3.3	25	---
194	10-13-59	U	7.9	---	---	201	---	72	4.5	---	266	.2	230	.03	---	.03	13	---	---	---	2.9	7	7.6	2.9	25	---
SNITZ CREEK FORMATION																									
41	10-12-59	U	7.6	---	---	245	---	69	4.6	---	338	.1	320	.04	---	.22	35	---	---	---	.59	1.4	11	2.7	64	---
166	10-13-59	U	7.4	---	---	258	---	84	12	---	389	.1	340	.07	---	.17	32	---	---	---	8.1	9	10	5.3	45	---
213	10-13-59	U	7.8	---	---	215	---	58	3.8	---	264	.1	250	.07	---	.05	26	---	---	---	.97	2	8.6	1.7	30	---
336	10-16-59	U	7.7	---	---	269	---	82	31	---	410	1.1	350	.41	---	.07	34	---	---	---	3.2	15	11	9	51	---
509	2-23-66	O	7.3	---	---	245	---	---	13	---	368	---	302	---	---	---	---	---	---	.006	---	---	---	---	---	---
520	10-16-59	U	7.6	---	---	167	---	66	6	---	247	.1	200	.06	---	.03	9.6	---	---	---	6.8	2.4	13	5	14	---
660	10-12-59	U	7.7	---	---	277	---	98	28	---	511	.4	390	.04	---	.02	34	---	---	---	21	10	12	24	45	---
953	10-7-81	O	7.5	.001	.11	244	<.0001	69.1	17	<.01	414	.18	270	.11	.001	.02	37.8	.02	.06	.002	7.56	6.1	---	7.2	55	.03
BUFFALO SPRINGS FORMATION																									
121	10-12-59	U	7.7	---	---	262	---	88	22	---	458	.1	360	.06	---	.41	33	---	---	---	16	18	13	10	45	---
185	10-13-59	U	7.7	---	---	151	---	46	5.8	---	218	.1	190	.07	---	.03	17	---	---	---	5.2	2.6	11	3.7	18	---
204	2-13-59	U	7.5	---	---	281	---	88	20	---	446	.1	340	.06	---	.01	29	---	---	---	8.1	3.4	19	27	55	---
521	10-21-59	U	7.3	---	---	239	---	78	6.2	---	354	.1	300	.08	---	.01	26	---	---	---	6.8	2.2	9.6	11	47	---
562	10-16-59	U	7.2	---	---	279	---	96	19	---	471	.0	380	.03	---	.02	33	---	---	---	17	11	9.9	18	41	---
564	9-1-81	O	7.6	.0039	.04	203	<.0001	88.2	50	<.01	484	.48	240	.05	.0028	.01	24.7	.03	.06	.002	6.82	5.26	---	28	25	.05
Sp-7	10-13-59	U	7.2	---	---	175	---	65	6.2	---	312	.1	250	.05	---	.14	20	---	---	---	2.5	3.6	25	7.1	69	---
LEITHSVILLE FORMATION																									
1043	9-3-81	O	7.6	<.005	.06	116	<.0005	22.1	2	<.01	124	.6	110	.09	<.005	.02	14.7	.02	.06	.002	.04	1.52	---	.9	< 5	.01
1044	9-3-81	O	6.1	<.005	.06	18	<.0005	3	2	<.01	52	.52	20	1.4	.0069	.06	1.7	.02	.06	.002	.54	2.92	---	1	< 5	.02

TABLE 8. (CONTINUED)

Well number	Date of collection	Data source[a]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Silica (SiO_2)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
HAROYSTON FORMATION																										
699	3-7-80	O	7.0	---	---	34	---	---	4	---	92	---	40	.11	---	<.01	---	---	.01	<.002	.18	---	---	---	40	---
701	6-2-42	O	7.8	---	---	69	---	---	1	---	80	---	74	.4	---	---	---	---	.01	.001	.1	---	---	---	---	---
702	5-28-63	C	---	---	---	56	---	12	1	---	109	---	60	.53	---	---	7.3	---	---	---	.7	---	14.4	10.7	24.2	---
GRANITE GNEISS																										
1049	10-7-81	O	6.2	<.005	.24	26	---	8.8	3	<.01	100	.16	30	.22	---	.01	1.8	.01	.06	.002	.24	.52	---	4.8	10	.04
HORNBLENDE GNEISS																										
1051	9-3-81	O	7.8	<.005	.06	74	<.0005	21.1	2	<.01	140	9	66	.04	.0097	.02	3.7	.02	.06	.002	.2	.76	---	14.2	5	.43

[a]U, U.S. Geological Survey; O, Dept. of Environmental Resources; C, commercial.
[b]Hammer Creek Formation, sandstone member.

TABLE 9. RECORD OF WELLS

Well location: The number that is assigned to identify the well. It is prefixed by a two-letter abbreviation of the county. The latitude and longitude (lat-long) are the coordinates, in degrees and minutes, of the southeast corner of a 1-minute quadrangle within which the well is located.

Use: A, air conditioning; C, commercial; H, household; I, irrigation; N, industrial; P, public; R, recreation; S, stock; T, institutional; U, unused; W, recharge; Z, other.

Topographic setting: C, stream channel; H, hilltop; S, hillside; T, terrace; V, valley; W, draw.

Aquifer: Qc, colluvium; Trd, diabase; Trhss, Hammer Creek Formation; Dcsc, Sherman Creek Member, Catskill Formation; Otr, Trimmers Rock Formation; Dmh, Mahantango Formation; Ohyb, Yellow Breeches thrust plate; Oh8, Hamburg sequence, lithotectonic unit 8; Oh6, Hamburg sequence, lithotectonic unit 6; Oh4, Hamburg sequence, lithotectonic unit 4; Oh3, Hamburg sequence, lithotectonic unit 3; Oh2, Hamburg sequence, lithotectonic unit 2; Oh1, Hamburg sequence, lithotectonic unit 1; Oh, Hamburg sequence rocks, undifferentiated; Om, Martinsburg Formation; Ohy, Hershey Formation; Omy, Myerstown Formation; Oan, Annville Formation; Oo, Ontelaunee Formation; Oe, Epler Formation; Ori, Rickenbach Formation; Os, Stonehenge Formation; Cr, Richland Formation; Cm, Millbach Formation; Cs, Schaefferstown Formation; Csc, Snitz Creek Formation; Cbs, Buffalo Springs Formation; Clv, Leithsville Formation; Cha, Hardyston Formation; gn, granite gneiss; hg, hornblende gneiss.

Lithology: cg, conglomerate; db, diabase; dol, dolomite; ls, limestone; sh, shale; ss, sandstone.

Static water level: Depth--F, flows but head is not known.
Date--month/last two digits of year.

Reported yield: gal/min, gallons per minute.

Specific capacity: (gal/min)/ft, gallons per minute per foot of drawdown.

Hardness: gpg, grains per gallon.

TABLE 9.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/lithology
Number	Lat-Long							
Lb- 12	4022-7618	Myerstown Bor.	---	---	U	445	V	Oo/dol
17	4023-7623	David Yingst	---	---	---	520	V	Oh6/sh
18	4024-7628	---	---	---	---	---	S	Oh2/---
19	4023-7629	---	---	---	---	---	H	Oh6/---
21	4020-7625	Hershey Creamery Co.	---	---	N	455	V	Oe/ls
23	4020-7625	Consumers Ice Co.	---	---	N	495	V	Oo/dol
24	4021-7625	George Boyer	---	---	---	515	S	Oh8/sh
27	4023-7619	Garloff	---	---	---	---	V	Oh8/sh
29	4019-7621	Iona Sch.	---	---	H	555	H	Cr/dol
33	4020-7614	Millbach Sch. House	---	---	---	---	S	Cm/---
34	4021-7612	Yeiser	---	---	---	---	V	Cm/---
40	4016-7629	S. C. Oickehoff	Kohl Bros., Inc.	1955	R	465	V	Cs/ls
41	4016-7629	R. J. Kreider	---	---	H	498	V	Csc/dol
42	4016-7629	A. H. Gingrich	---	1868	H	---	S	Cbs/ls
44	4016-7627	Lancaster Mennonite Conf.	---	1955	H	---	S	Cbs/ls
45	4016-7627	do.	---	1954	P	630	S	Oh/---
46	4016-7627	do.	---	1952	P	645	S	Oh/---
47	4016-7627	Wilson Ouorte	---	1920	H	---	V	Cbs/ls
49	4018-7626	Harold Frey	---	---	H	---	S	Os/ls
50	4018-7626	Ernest Yorty	---	---	H	500	S	Os/ls
51	4017-7627	Horace Spangler	---	1925	S	---	V	Cm/---
52	4017-7629	William Sheaffer	---	---	H	---	S	Cr/ls
53	4017-7629	do.	---	---	U	---	S	Cr/ls
54	4017-7628	George Wine	---	---	H	545	S	Cr/ls
55	4017-7628	George Kreider	---	---	H	501	S	Cr/ls
56	4017-7627	Mary Bachman	---	---	H	491	V	Cr/---
57	4018-7627	Howard Bomberger	R. A. Yaukey	---	H	469	S	Os/ls
58	4018-7627	William Ziegler	---	---	H	482	S	Os/ls
59	4018-7628	W. P. Yingst	---	1940	H	498	H	Os/ls
60	4018-7627	C. Forney	---	---	S	---	V	Os/---
61	4018-7628	do.	---	---	H	---	V	Os/ls
62	4018-7628	E. F. Forney	R. A. Yaukey	---	H	---	V	Os/ls
63	4018-7628	R. O. Smith	---	---	H	481	V	Os/ls
64	4018-7628	C. E. Habecker	---	---	H	---	V	Os/ls
65	4018-7628	N. L. Ratlift	---	---	H	---	S	Os/---
66	4018-7628	L. D. Smith	---	1949	H	468	V	Os/ls
67	4017-7628	A. H. Gingrich	---	---	H	491	V	Os/ls
68	4017-7629	Jacob Heagy	Elias Gessart	---	H	500	S	Cr/dol
69	4017-7629	do.	---	---	H	493	S	Cr/ls
70	4017-7629	H. C. Heagy	---	1937	---	483	S	Cr/ls
71	4017-7629	Isaac Wampler	---	---	H	---	S	Cr/ls
73	4017-7629	Emerson Snavely	Edwin Gerlach & Sons	1956	H	---	V	Cr/ls
74	4017-7629	Joseph Kreider	---	---	H	---	S	Cr/---
75	4017-7629	Raymond Heagy	---	---	H	---	V	Cr/ls
76	4017-7630	J. H. Heagy	R. A. Yaukey	---	H	---	S	Cs/ls
77	4017-7630	do.	---	---	U	442	V	Cs/ls
79	4018-7629	S. Stoner	---	---	H	---	V	Os/---
80	4018-7629	S. Stoner	Edwin Gerlach & Sons	---	H	---	S	Os/ls
81	4018-7629	E. H. Outweiler	Kohl Bros., Inc.	1945	H	---	S	Os/ls
82	4018-7629	do.	---	---	U	452	S	Os/ls
83	4018-7629	Charles Doutrich	---	---	H	---	H	Cr/ls
84	4018-7629	Urias Ulrich	---	---	H	---	S	Os/ls
85	4018-7629	Irwin Kroll	---	1940	H	480	S	Os/ls
86	4018-7629	John Rist	---	---	H	---	S	Os/ls
87	4018-7629	Leroy Heagy	Edwin Gerlach & Sons	---	H	472	S	Os/ls
88	4019-7629	Irwin Kroll	---	---	H	472	S	Oe/ls
89	4019-7628	David Kreider	---	---	H	469	S	Oe/ls
90	4019-7628	Harry Fisher	---	---	H	435	S	Oe/ls
91	4019-7628	do.	---	---	S	420	V	Oe/ls
92	4019-7628	O. K. Kreider	Kohl Bros., Inc.	1951	H	482	H	Os/ls
93	4019-7628	Nora Reist	---	---	H	---	S	Os/ls
94	4019-7628	Pierre Malm	---	---	H	438	S	Os/ls
95	4019-7628	Kline Copenhaver	---	---	H	---	S	Oe/ls
98	4016-7627	Ourtz May, Jr.	---	---	H	---	V	Csc/ls
99	4017-7627	Victor Bachman	---	---	H	488	S	Cm/ls
101	4016-7628	Marvin Mase	---	---	U	---	S	Cs/ls
102	4017-7629	Mark Ebersole	---	---	S	---	S	Cs/ls
103	4017-7628	Christian Hoffer	---	---	I	---	V	Cs/---
104	4018-7627	H. B. Bomberger	---	---	H	---	S	Os/ls
105	4017-7626	Herman Brandt	---	---	H	498	S	Cr/ls
106	4018-7626	Paul Strohm	---	1880	H	---	S	Os/ls
107	4018-7626	Rufus Nolt	---	1945	H	---	S	Os/ls
108	4018-7627	Herbert Levy	Jacob G. Wentzel	1956	H	---	S	Cr/ls
109	4018-7628	Adam Gerberich	---	---	H	---	S	Os/ls
110	4018-7628	Lebanon Country Club	Kohl Bros., Inc.	1955	P	450	H	Os/ls
111	4019-7627	L. Meyer	do.	1956	H	462	S	Os/ls
112	4019-7629	Kline Copenhaver	---	---	H	---	V	Oe/ls
113	4019-7629	do.	---	---	H	---	S	Oe/ls
114	4019-7629	John Funk	---	---	H	---	S	Oe/ls
115	4019-7629	Clair Hart	---	---	S	---	V	Oe/ls
116	4019-7629	do.	---	---	H	410	V	Oe/ls
117	4016-7627	Robert Kreider	---	---	H	---	V	Cbs/ls
119	4017-7629	Franklin Kreider	Fritz Bros.	1952	H	---	S	Cs/ls
120	4017-7629	Allen Funk	---	---	H	483	S	Csc/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
27	---	6	---	15	---	10	---	---	---	---	Lb- 12
90	---	6	---	20	---	15	---	---	---	---	17
50	---	6	---	20	---	15	---	---	---	---	18
90	---	6	---	50	---	10	---	---	---	---	19
164	---	6	---	10	---	150	---	---	---	---	21
400	---	8	---	40	---	160	---	---	---	---	23
150	---	6	---	80	---	20	---	---	---	---	24
60	---	6	---	20	---	15	---	---	---	---	27
185	---	6	---	60	---	25	---	---	---	---	29
150	---	6	---	40	---	20	---	---	---	---	33
90	---	6	---	30	---	40	---	---	---	---	34
97	---	---	---	20	---	18	---	12	475	7.3	40
---	---	6	---	---	---	---	---	17	600	7.5	41
---	---	8	---	71	5/56	---	---	10	450	7.2	42
109	---	6	---	23	8/57	---	.34	12	510	7.6	44
86	---	6	---	---	---	---	---	6	450	7.0	45
75	---	8	---	35	8/57	---	---	8	325	7.2	46
62	---	6	---	---	---	---	---	13	---	7.3	47
70	---	---	---	34	5/57	---	---	10	400	6.9	49
60	---	---	---	48	5/57	---	---	11	450	7.2	50
156	16	6	---	---	---	---	---	13	490	7.7	51
120	---	4	---	21	6/57	90	54	14	500	7.3	52
20	---	48	---	2	6/57	---	---	---	---	---	53
---	---	6	---	27	6/57	---	11	17	650	7.3	54
169	---	6	---	38	1956	---	---	13	575	7.1	55
---	---	---	---	37	6/57	---	19	12	300	7.3	56
99	---	6	---	31	6/57	---	.49	17	700	7.2	57
54	---	---	---	39	6/57	---	---	16	600	7.5	58
100	---	6	---	---	---	---	---	14	600	7.2	59
63	---	---	---	20	7/57	---	---	---	---	---	60
53	---	---	---	36	7/57	---	---	11	475	7.5	61
94	---	6	---	40	7/57	---	---	14	600	7.2	62
130	---	4	---	39	7/57	---	---	13	525	7.3	63
81	---	4	---	43	7/57	---	---	15	700	7.3	64
---	---	---	---	45	7/57	---	---	---	---	---	65
199	---	6	---	30	7/57	---	29	---	---	---	66
185	---	6	---	43	7/57	---	3.8	---	---	---	67
350	---	6	---	---	---	---	---	15	540	7.6	68
40	---	---	---	26	7/57	---	.01	---	---	---	69
120	---	---	---	44	7/57	---	---	17	625	7.2	70
25	---	---	---	25	1955	---	---	10	490	7.3	71
149	---	6	---	20	1956	6	---	6	650	7.5	73
---	---	---	---	29	7/57	---	---	14	575	7.2	74
50	---	6	---	19	7/57	---	---	---	---	---	75
148	100	6	---	20	1955	---	---	11	375	7.6	76
---	---	6	---	11	7/57	---	---	---	---	---	77
65	---	---	---	47	7/57	---	---	---	---	---	79
115	---	6	---	---	---	---	---	11	450	7.6	80
127	---	6	---	---	---	---	---	11	450	7.3	81
35	---	---	---	28	7/57	---	---	---	---	---	82
140	---	6	---	70	---	---	---	16	700	7.5	83
57	---	---	---	42	---	---	---	14	650	7.3	84
---	---	6	---	50	7/57	---	78	19	850	7.0	85
---	---	6	---	---	---	---	---	14	490	7.3	86
250	51	6	---	53	7/57	---	---	18	750	7.2	87
---	---	6	---	68	7/57	---	15	15	600	7.0	88
200	---	6	---	46	7/57	---	---	21	900	7.1	89
---	---	6	---	36	7/57	---	---	19	710	7.2	90
---	---	---	---	23	7/57	---	---	---	---	---	91
137	---	6	---	---	---	---	---	16	550	7.3	92
57	---	6	---	24	1946	---	---	12	420	7.6	93
---	---	---	---	17	7/57	---	---	---	---	---	94
---	---	---	---	15	7/57	---	---	17	660	7.2	95
---	---	---	---	19	7/57	---	---	---	---	---	98
---	---	---	---	14	7/57	---	5.2	16	600	7.2	99
120	---	---	---	38	7/57	---	---	---	---	---	101
47	---	---	---	36	7/57	---	---	---	---	---	102
---	---	---	---	24	7/57	---	---	13	550	7.5	103
---	---	---	---	26	7/57	---	---	13	480	7.3	104
60	---	---	---	44	7/57	---	.52	10	490	---	105
90	---	6	---	38	7/57	---	---	17	600	7.4	106
175	---	6	---	---	---	---	---	17	560	7.4	107
275	---	6	---	57	7/57	23	---	12	460	7.3	108
20	---	---	---	---	---	---	---	12	435	7.4	109
100	---	8	---	19	7/57	225	160	12	450	7.3	110
200	---	6	---	56	6/57	---	---	15	500	7.3	111
80	---	6	---	42	7/57	---	---	14	525	7.4	112
---	---	6	---	58	7/57	---	---	14	550	7.3	113
180	---	6	---	---	---	---	---	17	595	7.4	114
16	---	---	---	8	7/57	---	---	---	---	---	115
21	---	---	---	15	7/57	---	---	---	---	---	116
210	---	6	---	50	---	---	---	14	550	7.3	117
130	60	6	---	31	7/57	30	---	---	---	---	119
---	---	---	---	34	7/57	---	---	15	520	7.2	120

TABLE 9.

Well location		Owner	Oriller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 121	4016-7627	Jacob Harte	---	---	H	540	S	Cbs/ls
122	4017-7625	Richard Bucher	---	---	H	522	V	Csc/ls
123	4017-7625	Bernard Embich	---	---	H	---	V	Csc/ls
124	4017-7626	Wilfred Shirk	---	---	H	594	V	Csc/ls
125	4017-7626	A. Ruhl	---	1935	H	---	S	Csc/ls
127	4017-7625	R. H. Risser	---	---	H	524	S	Csc/ls
128	4018-7625	Luke Hostetter	---	---	H	---	V	Cr/ls
129	4018-7625	Abel Hauck	---	---	S	---	S	Cr/ls
130	4018-7625	do.	---	---	H	494	S	Cr/ls
133	4018-7626	Marvin Mase	Jacob G. Wentzel	1949	H	---	H	Cr/ls
134	4018-7626	Raymond Light	---	---	H	516	H	Cr/ls
135	4018-7626	J. R. Brimmer	Kohl Bros., Inc.	1946	H	---	S	Cr/ls
136	4018-7626	Catherine Mase	Jacob G. Wentzel	1952	S	---	S	Cr/ls
137	4019-7626	Elmer Zimmerman	---	---	H	462	S	Cr/---
138	4019-7626	Ernest Edris	Kohl Bros., Inc.	1936	H	---	V	Cr/ls
139	4018-7626	Charles Whitman	---	1943	H	501	S	Cr/ls
140	4018-7626	Arthur Groff	---	---	H	522	S	Cr/dol
141	4018-7625	Roy Risser	---	---	H	---	S	Cr/ls
143	4019-7627	Stanley Smith	---	1939	H	---	S	Os/ls
144	4019-7626	S. Laudermilch	---	---	H	---	S	Os/ls
145	4019-7627	Harvey Kline	---	---	H	---	V	Os/ls
146	4019-7627	F. Laudermilch	---	---	H	---	V	Os/ls
147	4019-7627	C. N. Miller	---	---	H	---	V	Os/ls
148	4019-7626	John Kleinfelter	---	---	H	460	V	Os/ls
149	4019-7626	J. Kleinfelter	---	---	S	---	V	Os/ls
150	4019-7626	do.	---	---	H	469	V	Os/ls
151	4018-7625	H. S. Bomberger	---	---	H	---	V	Cr/ls
152	4018-7625	Calvin Spitler	---	---	H	---	V	Cr/dol
153	4018-7625	Ben Tuck	---	---	H	498	H	Cm/ls
154	4018-7625	do.	---	---	S	---	V	Cm/ls
155	4018-7625	Adam Hauck	Kohl Bros., Inc.	1923	H	532	V	Cr/ls
156	4017-7625	Roy Risser	---	---	H	---	V	Cr/ls
157	4017-7625	do.	---	---	H	485	S	Cr/ls
158	4018-7625	David Ebersole	---	---	H	473	S	Cr/ls
159	4018-7625	Alex Bomberger	---	---	H	531	V	Cr/ls
160	4018-7624	A. S. Bomberger	---	---	H	---	V	Cr/ls
161	4018-7624	Elijah Arnold	---	---	H	---	V	Cr/ls
162	4018-7624	R. J. Horst	---	---	H	---	V	Cs/ls
163	4018-7624	Stanley Smith	---	---	H	550	V	Csc/ls
164	4018-7624	Isaac Patches	---	---	H	---	V	Csc/ls
165	4018-7624	Joseph Schott	---	1921	H	---	V	Csc/ls
166	4017-7624	J. H. Schott	---	1921	H	598	H	Csc/dol
167	4017-7624	Leonard Schott	---	---	H	---	V	Cbs/ls
168	4017-7624	J. R. Sanger	---	---	H	---	V	Csc/ls
169	4017-7624	M. R. Jennings	---	---	H	552	S	Csc/ls
170	4017-7624	Harry Geib	---	---	H	---	S	Csc/ls
171	4017-7623	John Starner	Jacob G. Wentzel	1955	H	---	V	Cbs/ls
172	4017-7623	R. V. Yeagley	---	---	H	573	V	Cbs/ls
173	4017-7623	Eugene Moore	---	1946	H	---	V	Cbs/ls
174	4017-7624	Samuel Peiffer	Kohl Bros., Inc.	1945	H	---	V	Csc/ls
175	4017-7623	John Shearer	---	---	H	589	V	Cbs/ls
176	4017-7623	Warren Lewars	---	---	H	---	V	Cbs/ls
177	4017-7623	Jacob Krall	---	1957	H	---	S	Cbs/ls
178	4017-7623	Rufus Musser	Kohl Bros., Inc.	---	H	560	V	Cbs/ls
179	4018-7623	Stanley Smith	---	---	H	---	V	Cbs/ls
180	4018-7623	G. K. Ruhl	---	---	H	545	V	Cbs/ls
181	4018-7623	J. H. Oohner	---	1948	H	---	S	Csc/ls
182	4018-7622	John Tomasco	---	---	U	535	V	Cbs/ls
183	4018-7623	Stanley Smith	---	---	H	---	V	Cbs/ls
184	4017-7623	P. R. Horst	---	---	H	---	S	Cbs/---
185	4017-7622	J. J. Hurst	---	1954	H	595	S	Cbs/ls
186	4018-7623	I. S. Parker	Kohl Bros., Inc.	1943	H	519	V	Csc/ls
187	4018-7623	Ralph Heckard	---	1950	H	---	S	Cs/ls
188	4018-7622	Howard Weiss	Kohl Bros., Inc.	1945	H	---	V	Cs/ls
189	4018-7622	John Royer	---	1912	H	---	V	Cs/ls
190	4018-7622	do.	---	---	U	547	V	Cs/ls
191	4018-7622	Raymond Risser	---	---	H	533	V	Cs/ls
192	4018-7622	Cyril Blouch	Kohl Bros., Inc.	1943	H	---	V	Cm/ls
193	4018-7623	Allen Martin	---	---	H	---	V	Cm/ls
194	4018-7623	W. H. Becker	Elias Gessart	1930	H	505	V	Cs/ls
195	4019-7622	Samuel Musser	---	---	H	498	V	Os/ls
196	4020-7622	Warren Meyer	Kohl Bros., Inc.	---	H	---	V	Os/ls
197	4020-7622	Arthur Funk	---	---	H	---	V	Os/ls
199	4017-7622	J. H. Kapp	---	---	H	612	V	Cbs/ls
200	4017-7622	Adam Batdorf	Kohl Bros., Inc.	---	H	---	V	Cbs/ls
201	4017-7623	Hanna Binner	---	---	H	---	V	Cbs/ls
202	4017-7625	Edward Quarry	---	---	H	---	V	Cbs/ls
203	4016-7624	Richard Bucher	---	---	S	611	V	Cbs/ls
204	4016-7623	Isaac Horst	---	---	H	620	S	Cbs/ls
206	4016-7623	Samuel Wenger	---	---	H	682	S	Trd/db
207	4016-7623	do.	---	---	S	---	V	Cbs/ls
208	4016-7623	do.	---	---	H	---	V	Cbs/ls
209	4018-7624	Henry Kreider	---	1937	H	508	V	Cm/ls
210	4018-7623	U. S. Veterans Admin.	---	---	H	---	V	Cs/ls
211	4018-7623	Paul Kuhlman	Myers Bros. Drilling Contractors	1953	H	---	H	Csc/ls
212	4018-7623	Jacob Livering	---	---	H	---	V	Csc/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
150	---	6	---	32	7/57	---	24	16	550	7.3	Lb- 121
---	---	---	---	27	7/57	---	13	---	---	---	122
---	---	---	---	23	7/57	---	---	---	---	---	123
39	---	---	---	36	7/57	---	1.6	---	---	---	124
400	---	6	---	---	---	---	---	16	500	7.5	125
---	---	6	---	31	7/57	---	---	16	600	7.3	127
---	---	6	---	30	7/57	---	---	11	550	7.2	128
---	---	6	---	---	---	---	---	12	490	7.4	129
---	---	---	---	43	7/57	---	---	11	470	7.5	130
193	---	6	---	---	---	---	.07	18	700	7.5	133
200	---	6	---	18	7/57	---	---	18	750	7.3	134
153	12	6	---	29	7/57	---	---	18	650	7.4	135
130	20	6	---	20	7/57	---	.18	18	640	7.3	136
26	---	---	---	13	7/57	---	---	13	550	7.3	137
50	40	6	---	18	---	---	---	13	500	7.3	138
165	---	6	---	49	7/57	---	.98	---	---	---	139
---	---	6	---	36	7/57	20	---	16	1200	7.3	140
30	---	---	---	20	7/57	---	---	18	800	7.0	141
50	---	---	---	20	1940	---	---	13	495	7.3	143
---	---	---	---	36	7/57	---	---	16	555	7.3	144
42	---	---	---	32	7/57	---	---	16	600	7.3	145
40	---	---	---	36	7/57	---	---	16	595	7.3	146
---	---	---	---	19	7/57	---	---	14	500	7.5	147
30	---	---	---	19	7/57	---	73	14	530	7.3	148
30	---	---	---	16	7/57	---	---	---	---	---	149
---	---	6	---	36	7/57	---	1	---	---	---	150
29	---	---	---	13	7/57	---	---	16	620	7.3	151
27	---	---	---	20	9/59	---	68	14	515	7.7	152
---	---	---	---	---	---	---	---	15	570	7.3	153
---	---	---	---	---	---	---	---	12	455	7.5	154
200	100	6	---	45	9/59	---	3.5	21	795	7.2	155
---	---	6	---	---	---	---	---	15	500	7.3	156
30	---	---	---	30	7/57	---	---	12	565	7.3	157
---	---	---	---	11	7/57	---	---	---	---	---	158
350	---	---	---	67	9/59	---	65	12	455	7.3	159
285	---	6	---	85	7/57	---	---	14	485	7.5	160
---	---	6	---	35	7/57	---	---	14	610	7.3	161
96	---	6	---	46	7/57	---	---	12	450	7.3	162
100	---	6	---	34	9/59	---	1.4	14	530	7.3	163
160	---	6	---	---	---	---	---	15	560	7.3	164
110	22	6	---	64	7/57	---	---	14	495	7.7	165
182	60	6	---	84	7/57	---	.05	17	640	7.4	166
65	---	---	---	49	7/57	---	3.4	17	810	7.3	167
85	---	---	---	59	7/57	---	---	11	425	7.9	168
---	---	---	---	53	9/59	---	---	14	475	7.8	169
140	---	8	---	37	7/57	---	---	16	550	7.3	170
203	80	6	---	50	7/57	---	---	13	500	7.6	171
80	---	---	---	66	9/59	---	3.2	9	590	7.4	172
100	---	6	---	58	7/57	---	---	12	445	7.0	173
90	---	6	---	---	---	---	---	13	480	7.6	174
80	---	---	---	80	9/59	---	---	13	480	7.6	175
80	---	---	---	63	7/57	---	---	---	---	---	176
303	64	6	---	52	7/57	12	---	---	---	---	177
95	---	6	---	59	9/59	---	---	14	500	7.6	178
100	---	6	---	23	7/57	---	---	14	540	7.6	179
57	---	---	---	41	7/57	---	4.9	10	390	7.8	180
165	---	6	---	---	---	8	---	21	750	7.6	181
---	---	---	---	28	7/57	---	---	13	560	7.6	182
---	---	---	---	25	7/57	---	---	9	360	7.8	183
90	25	6	---	---	---	---	---	14	510	7.8	184
177	---	6	---	---	---	---	---	11	390	7.8	185
260	---	6	---	30	7/57	---	---	12	440	7.7	186
320	---	6	---	---	7/57	59	---	12	430	7.8	187
96	---	6	---	59	7/57	---	---	10	440	7.7	188
90	---	6	---	78	7/57	---	---	14	620	7.5	189
110	---	6	---	67	7/57	---	---	---	---	---	190
80	---	6	---	58	7/57	---	160	9	370	7.8	191
90	50	6	---	---	---	---	---	12	450	7.9	192
60	---	6	---	43	7/57	---	---	11	400	7.7	193
70	---	6	---	31	7/57	---	6.8	14	550	7.6	194
40	---	6	---	33	9/59	---	61	16	745	7.3	195
265	---	6	---	---	---	---	---	18	770	7.4	196
90	---	6	---	---	---	---	---	16	625	7.6	197
---	---	---	---	47	7/57	---	130	14	630	7.7	199
---	---	6	---	---	---	---	---	11	350	7.9	200
300	---	6	---	---	---	---	---	27	910	7.5	201
87	20	6	---	30	---	---	---	18	685	7.8	202
---	---	---	---	28	7/57	---	.06	---	---	---	203
20	---	---	---	17	7/57	---	---	14	640	7.6	204
25	---	---	---	19	7/57	---	---	8	350	7.3	206
85	45	6	---	23	7/57	---	---	12	550	7.2	207
60	---	---	---	52	7/57	---	---	11	470	7.3	208
85	---	6	---	25	9/59	---	---	13	480	8.0	209
---	---	---	---	21	7/57	---	---	14	520	7.4	210
200	8	6	---	35	7/57	6	---	17	650	7.8	211
42	---	---	---	38	7/57	---	---	12	445	7.4	212

TABLE 9.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 213	4018-7623	L. J. Livering	Kohl Bros., Inc.	1949	H	565	S	Csc/dol
214	4018-7623	H. N. Funk	do.	1951	H	---	S	Csc/ls
215	4018-7623	Clara Oraun	---	---	H	---	V	Csc/ls
216	4018-7623	Miles Weaber	Kohl Bros., Inc.	1952	H	557	S	Csc/ls
217	4019-7623	Benjamin Kroll	---	---	H	515	S	Cr/dol
218	4019-7623	James Vanscyoc	---	---	H	488	S	Cr/ls
219	4019-7624	Adam Fernsler	---	---	H	527	S	Cr/ls
220	4019-7625	Walter Martz	---	1910	H	519	V	Cr/ls
221	4019-7625	Joseph Kovach	---	---	H	---	V	Cr/ls
222	4019-7625	do.	---	1919	H	506	V	Cr/ls
223	4019-7624	Paul Sholley	---	---	H	487	V	Cr/ls
224	4019-7624	Robert Seagrist	---	---	U	493	V	Cr/ls
225	4019-7624	Lester Miller	---	---	H	---	W	Cr/ls
226	4019-7624	U. S. Veterans Admin.	---	---	U	---	V	Cr/ls
227	4020-7624	Henry Arnold	---	---	H	---	S	Oe/ls
228	4019-7623	Charles Arnold	Kohl Bros., Inc.	1940	H	---	V	Ori/ls
229	4019-7623	George Horse	---	1925	H	483	V	Os/ls
230	4016-7629	Mrs. C. B. Bowman	---	---	H	580	S	Trd/db
231	4016-7629	Mrs. Catherine Bowman	---	1953	H	630	V	Trhss/ss
232	4016-7629	Glen Smith	---	---	H	530	S	Cbs/ls
233	4016-7629	Edward Smith	Kohl Bros., Inc.	1950	H	---	V	Csc/ls
234	4016-7629	do.	---	---	U	---	S	Csc/---
235	4016-7629	R. R. Moyer	---	---	H	---	S	Csc/ls
236	4016-7630	Mrs. Harvey Rhine	---	1929	H	566	H	Csc/ls
237	4017-7628	Isaac Lentz	Kohl Bros., Inc.	1937	H	---	S	Cm/ls
238	4017-7627	Irvin Krall	---	---	H	500	V	Cm/ls
239	4018-7623	Marlin Dohner	Jacob G. Wentzel	1955	H	---	V	Csc/---
240	4019-7622	J. W. Fonderwhite	---	1942	H	500	S	Cm/ls
241	4019-7623	Howard Patches	---	---	H	497	W	Cr/ls
242	4019-7623	do.	Kohl Bros., Inc.	1942	H	---	V	Cr/ls
243	4016-7625	Amalgamated Clothing Workers	Harrisburg's Kohl Bros.	1955	R	560	V	Oh/ls
244	4016-7626	do.	do.	1955	U	555	V	Cbs/ls
245	4016-7625	do.	do.	1956	U	560	V	Cbs/ls
246	4016-7625	do.	do.	1956	R	555	V	Cbs/ls
247	4016-7625	do.	do.	1957	P	575	V	Oh/ls
249	4017-7628	Mark Hershey	---	---	U	518	S	Cs/ls
250	4017-7628	M. C. Hershey	---	---	H	515	S	Cs/ls
256	4020-7628	John Long	---	---	H	---	V	Oe/ls
259	4020-7629	A. P. Miller	---	---	H	540	H	Oh8/sh
260	4020-7629	Albert Laudermilch	---	1947	H	556	H	Oh8/ls
263	4020-7629	Hill Lutheran Ch.	---	---	P	---	S	Oh8/---
265	4020-7629	Aaron Stager	Kohl Bros., Inc.	1954	H	---	S	Oan/ls
268	4020-7629	E. M. Books	---	---	U	---	S	Oan/ls
275	4020-7627	Earl Kellar	Jacob G. Wentzel	1948	H	454	V	Oo/dol
277	4020-7628	Walter Zeller	---	---	H	575	S	Oh8/ls
279	4020-7628	Henry Sherer	---	1950	H	---	T	Oh8/---
281	4020-7628	Mervin Sipe	Robert L. Gerlach	1955	H	530	S	Oh8/ls
287	4020-7628	Joseph Sprecher	---	---	H	---	W	Oh8/ls
289	4020-7620	Arthur Brown	Kohl Bros., Inc.	---	H	---	V	Cr/---
290	4020-7620	Emmanuel Deck	do.	1957	H	---	W	Ori/ls
291	4020-7623	M. S. Arnold	---	---	H	486	V	Oe/ls
292	4020-7623	Jacob Arnold	---	---	H	---	V	Oe/ls
293	4020-7623	Mark Ruhl	---	1931	H	483	V	Os/---
294	4020-7622	Paul Wentzel	---	---	H	---	V	Ori/ls
295	4020-7623	Oavid Sattazhan	---	---	S	---	V	Oe/ls
296	4029-7622	Minna Riddle	---	---	H	---	S	Oo/ls
297	4021-7623	Allen Kleinfelter	---	---	H	---	W	Ohy/ls
298	4021-7623	U. S. Steel	Kohl Bros., Inc.	1952	H	550	S	Oh8/sh
299	4021-7624	John Anspach	---	---	H	---	V	Oan/---
300	4018-7622	Henry King	---	---	U	600	V	Csc/ls
301	4018-7621	do.	---	---	H	---	V	Cbs/ls
302	4017-7622	Stanley Smith	---	---	H	599	V	Cbs/ls
303	4018-7622	Charles Gingrich	Jacob G. Wentzel	---	H	---	V	Cm/ls
304	4018-7622	do.	do.	1931	H	---	W	Cm/ls
305	4019-7621	H. J. Newmaster	---	---	H	---	V	Cr/ls
306	4020-7621	H. Phares	---	---	H	---	S	Oe/ls
307	4019-7621	Jesse Miller	---	---	H	---	V	Cr/ls
308	4018-7621	Russel Hitz	---	---	H	---	V	Cs/ls
309	4018-7621	Rufus Musser	---	---	H	---	S	Cs/ls
310	4021-7617	H. C. Eberly	---	---	H	---	V	Ori/---
311	4021-7623	Henry Weiss	---	---	H	526	V	Oh8/---
315	4021-7622	Howard Smith	---	---	H	582	V	Oh8/sh
316	4021-7622	Harlan Bross	---	---	H	557	V	Ohy/---
317	4021-7622	Kessler	---	---	H	560	V	Ohy/ls
318	4021-7622	Elmer Waltermeyer	Jacob G. Wentzel	---	H	---	V	Ohy/---
319	4019-7627	Wengert Dairies	Kohl Bros., Inc.	---	U	459	H	Oe/ls
320	4019-7627	do.	---	---	H	---	V	Oe/ls
322	4020-7627	Albert Silldorff	---	---	H	480	H	Oe/ls
323	4020-7627	J. H. Sprecher	---	---	H	---	H	Omy/---
324	4021-7622	Richard Bemesderfer	---	---	H	510	V	Oo/dol
325	4021-7622	Nathan Ober	---	1952	H	515	V	Oo/ls
326	4020-7622	Ralph Richards	---	---	U	---	V	Oo/ls
327	4022-7621	Asa Martin	---	---	H	---	V	Ohy/ls
328	4021-7621	Elizabeth Kline	---	---	H	518	V	Ohy/ls
329	4021-7622	Henry Zook	---	---	H	---	V	Ohy/ls
330	4021-7620	Lester Martin	---	---	H	---	V	Oe/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
303	---	6	37;120;290	33	---	---	---	14	480	7.5	Lb- 213
256	8	6	---	53	7/57	4	---	17	600	7.6	214
42	---	6	---	---	---	---	---	15	640	7.4	215
255	---	6	---	---	---	---	.75	16	555	7.65	216
32	---	---	---	26	7/57	---	---	13	490	7.5	217
---	---	6	---	28	7/57	---	---	17	870	7.1	218
175	---	6	---	63	7/57	---	3.2	22	845	7.2	219
125	40	6	---	66	9/59	---	---	---	---	---	220
150	---	6	---	49	7/57	---	---	14	550	7.6	221
120	8	6	---	24	9/59	---	---	27	1025	7.6	222
83	---	6	---	31	9/59	---	---	14	540	7.6	223
---	---	6	---	37	7/57	---	---	---	---	---	224
196	---	6	---	100	---	---	---	18	635	7.5	225
---	---	---	---	19	7/57	---	---	---	---	---	226
50	---	---	---	38	7/57	---	---	18	690	7.3	227
85	40	6	---	27	7/57	---	360	13	450	7.6	228
175	---	6	---	8	7/57	---	---	13	450	7.6	229
30	---	---	---	23	7/57	---	---	14	600	6.8	230
86	---	6	---	3	7/57	---	.06	7	275	7.6	231
85	---	---	---	38	7/57	---	---	9	335	7.5	232
49	40	6	---	---	---	---	---	10	370	7.4	233
28	---	---	---	8	7/57	---	---	---	---	---	234
80	---	6	---	49	7/57	---	8	15	590	7.6	235
275	20	6	---	85	7/57	---	---	15	590	7.6	236
77	---	6	---	30	7/57	---	---	15	550	7.6	237
120	---	6	---	37	7/57	---	---	13	490	7.6	238
157	---	6	---	---	---	---	---	18	610	7.5	239
47	---	6	---	28	7/57	---	300	18	710	7.3	240
---	---	6	---	23	7/57	---	---	13	490	7.5	241
90	---	6	---	---	---	---	---	19	700	7.2	242
350	38	6	---	10	4/55	42	.21	---	---	---	243
295	26	6	---	3	1955	3	.02	---	---	---	244
500	68	6	---	10	---	150	1.2	---	---	---	245
500	50	6	---	29	7/56	95	.76	---	---	---	246
300	105	6	---	55	7/57	54	.40	---	---	---	247
---	---	---	---	30	8/57	---	25	---	---	---	249
35	---	---	---	31	8/57	---	---	15	565	7.3	250
---	---	---	---	---	---	---	---	19	840	7.2	256
70	---	6	---	---	---	---	---	4	195	7.1	259
120	---	6	---	42	8/57	---	---	3	165	7.2	260
30	---	---	---	---	---	---	---	9	365	7.5	263
113	100	6	---	43	8/57	30	1.6	14	485	7.5	265
170	104	6	---	72	---	---	---	17	640	7.6	268
68	---	6	---	19	8/57	---	---	22	795	7.4	275
70	---	6	---	38	8/57	---	---	5	265	6.8	277
---	---	6	---	20	8/57	---	---	10	400	7.7	279
200	---	6	---	30	8/57	---	---	10	400	8.2	281
150	---	6	---	36	8/57	---	---	11	410	7.8	287
40	---	6	---	7	10/56	---	---	19	860	---	289
162	22	6	156	20	9/57	---	---	---	---	---	290
---	---	---	---	26	9/57	---	---	14	570	7.3	291
---	---	6	---	---	---	---	---	11	460	7.8	292
100	---	6	---	17	9/57	---	250	15	540	7.7	293
83	---	6	---	---	---	---	---	12	490	7.9	294
---	---	6	---	22	9/57	---	---	37	1800	7.2	295
100	---	6	---	---	---	---	---	22	875	7.7	296
---	---	6	---	---	---	---	---	18	775	7.8	297
150	---	6	---	---	---	---	---	5	220	8.4	298
155	---	6	---	---	---	24	---	13	460	7.9	299
96	---	---	---	77	9/57	---	10	---	---	---	300
65	---	---	---	50	9/57	---	---	11	460	7.4	301
200	---	6	---	69	9/57	---	.07	12	490	---	302
95	---	6	---	---	---	---	---	16	650	7.4	303
95	---	6	---	56	9/57	---	---	16	575	7.7	304
78	---	6	---	23	8/57	6	---	22	850	7.2	305
120	---	6	---	---	---	---	---	17	640	7.6	306
117	---	6	---	40	---	---	---	---	---	---	307
20	---	---	---	5	1957	---	---	13	470	---	308
52	---	---	---	47	9/57	---	240	16	560	7.9	309
200	---	6	---	---	---	---	---	22	1000	---	310
---	---	---	---	11	8/57	---	1.4	17	690	7.3	311
75	---	6	---	22	9/57	---	---	4	185	7.2	315
75	---	---	---	8	9/57	---	---	10	450	7.2	316
15	---	---	---	8	9/57	---	---	13	610	7.6	317
100	---	6	---	15	1954	---	---	14	530	7.2	318
108	---	6	---	32	9/57	2	---	---	---	---	319
150	---	6	---	---	---	25	---	18	650	7.4	320
175	---	6	---	---	---	---	---	15	650	7.4	322
50	---	---	---	19	9/57	---	---	8	425	---	323
80	---	6	---	---	---	---	---	23	1040	7.1	324
80	---	6	---	43	9/57	---	---	20	740	7.6	325
30	---	6	---	21	9/57	---	---	---	---	---	326
40	---	---	---	---	---	---	---	12	500	7.9	327
36	---	---	---	8	9/57	---	.40	9	350	8.2	328
---	---	6	---	---	---	---	---	15	600	7.7	329
25	---	---	---	23	---	---	---	17	700	---	330

TABLE 9.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/lithology
Number	Lat-Long							
Lb- 331	4022-7620	Dept. of Highways	---	---	P	468	V	Omy/ls
332	4021-7617	J. L. Martin	---	---	U	469	V	Oe/ls
333	4021-7617	do.	---	---	H	480	S	Oe/ls
334	4022-7618	Quaker Alloy Casting Co.	Kohl Bros., Inc.	1957	N	440	V	Oo/dol
335	4017-7618	Ammon Fisher	---	---	H	---	V	Cs/ls
336	4017-7618	do.	---	---	U	539	V	Csc/dol
337	4017-7618	Walter Elsesser	---	---	H	---	S	Csc/ls
338	4017-7618	Nathan Oulebohn	---	---	H	580	S	Trhss/sh
339	4017-7617	Harrison Matz	Kohl Bros., Inc.	1946	H	620	S	Trhss/sh
340	4017-7617	Franklin Wike	---	---	H	580	V	Trhss/sh
341	4017-7616	Heidelberg Water Co.	Kohl Bros., Inc.	1932	U	625	V	Oh/---
342	4018-7616	do.	do.	1950	U	635	V	Oh/---
343	4020-7615	J. M. Griffe	---	1932	H	---	H	Os/ls
344	4020-7617	Howard Weiss	---	---	H	516	S	Cr/dol
345	4019-7625	R. E. Light	---	1952	H	---	H	Cr/ls
351	4019-7626	Clarence Klepper	Kohl Bros., Inc.	---	H	---	S	Os/ls
352	4019-7626	George Vucetic	Jacob G. Wentzel	1955	H	---	V	Oe/ls
353	4019-7627	Nips Motor Co.	---	---	C	---	V	Oe/ls
358	4021-7623	Harry Yingst	---	---	U	---	H	Oh8/sh
362	4018-7624	Leonard Schott	---	---	U	---	V	Cr/ls
363	4020-7625	Consumers Ice & Supply Co.	---	---	U	492	V	Oo/---
364	4020-7625	do.	---	---	U	---	S	Oo/ls
365	4020-7625	do.	Kohl Bros., Inc.	1947	N	---	V	Oo/ls
366	4020-7625	Puritan Dairy	---	1944	N	498	H	Oo/dol
369	4019-7626	H. S. Engart	---	1947	I	---	V	Os/ls
370	4019-7625	Walter Graeff	Kohl Bros., Inc.	1939	H	482	S	Os/ls
371	4020-7625	Levitz Furniture Co.	do.	---	A	---	S	Oe/ls
372	4022-7618	Kohl Bros., Inc.	---	---	U	444	V	Oo/dol
373	4022-7618	Roy Sattazahn	Kohl Bros., Inc.	1956	U	477	H	Ohy/ls
374	4020-7624	Lebanon Steel Foundry	do.	1942	N	---	V	Oo/ls
375	4020-7624	do.	do.	1942	U	---	V	Oo/---
376	4020-7624	do.	do.	1942	U	---	V	Oo/---
377	4020-7626	Levitz	---	---	U	460	V	Oo/---
378	4021-7622	Lebanon Chemical Co.	Kohl Bros., Inc.	---	U	---	V	Oo/ls
380	4020-7624	Lincoln Diner	do.	1952	A	---	S	Oe/ls
381	4022-7617	A. W. Beyler & Sons	do.	1955	I	450	V	Oan/ls
382	4020-7625	Hershey Chocolate	do.	---	N	---	S	Oe/ls
383	4022-7618	American Legion	do.	1949	A	---	S	Ohy/ls
384	4019-7616	I. B. Mock	---	1955	H	---	V	Csc/---
385	4020-7625	Academy Theatre	Kohl Bros., Inc.	1949	A	---	V	Oe/ls
386	4020-7625	Colonial Theatre	do.	---	A	---	V	Oe/ls
412	4017-7617	Heidelberg Water Co.	do.	1959	P	620	V	Trhss/ss
413	4018-7617	do.	do.	1959	U	635	S	Oh/sh
423	4020-7630	Annville Water Co.	---	---	U	540	W	Oh8/sh
429	4016-7625	Amalgamated Clothing Workers	Harrisburg's Kohl Bros.	1957	U	560	V	Cbs/ls
430	4016-7625	do.	do.	1958	R	560	V	Cbs/ls
431	4015-7624	Cornwall Munic. Water Authority	Kohl Bros., Inc.	1955	U	664	S	Trhss/ss
432	4015-7623	do.	do.	1963	P	800	S	Trhss/ss
433	4014-7628	Mt. Gretna Camp Meeting Assn.	---	1944	P	740	S	Trhss/ss
434	4014-7627	Mt. Gretna Heights Water Co.	---	1922	P	840	S	Trhss/ss
435	4016-7626	Quentin Water Co.	---	1940	P	---	S	Cbs/---
436	4016-7626	do.	---	---	P	---	S	Oh/---
439	4012-7634	Gulf Oil Corp.	Harrisburg's Kohl Bros.	1950	C	490	V	Trhss/ss
440	4012-7634	do.	do.	1950	C	490	V	Trhss/ss
441	4012-7634	do.	do.	1950	C	490	V	Trhss/ss
442	4026-7626	Fredericksburg Water Co.	---	---	P	490	V	Oh3/---
443	4026-7626	do.	Kohl Bros., Inc.	1940	P	490	V	Oh3/---
444	4026-7626	do.	do.	1959	P	500	V	Oh3/---
445	4025-7634	U. S. Army	Harrisburg's Kohl Bros.	---	Z	490	S	Oh1/---
467	4015-7634	Donald Eddinger	do.	1953	H	665	S	Trhss/ss
486	4020-7617	Elco Sch. District	Kohl Bros., Inc.	1970	T	515	S	Cr/---
490	4019-7625	E. J. Guerrisi	O. B. Gill	1958	H	510	H	Cr/---
493	4015-7627	West Cornwall Twp.	Sprague & Henwood, Inc.	1959	U	720	S	Trhss/ss
501	4017-7621	Allan Laudermilch	---	1780	H	561	S	Cbs/---
502	4017-7621	G. J. Krall	---	1956	H	---	S	Cbs/ls
503	4018-7621	Oscar Herr	John H. Mays	---	H	594	V	Csc/---
504	4017-7620	Herman Brandt	---	---	H	---	H	Cbs/ls
505	4017-7619	Mark Keller, Jr.	Kohl Bros., Inc.	1945	H	---	V	Csc/---
506	4018-7619	Paul Himmelberger	---	---	H	584	V	Csc/---
507	4018-7619	Raymond Gibble	Harrisburg's Kohl Bros.	1957	H	---	V	Csc/---
508	4018-7619	L. H. Wenrich	---	1941	H	---	V	Cbs/---
509	4018-7619	Hill Crest View	C. S. Garber & Sons, Inc.	1957	P	610	S	Cbs/---
510	4018-7619	Keller	do.	---	U	---	V	Cbs/---
511	4018-7619	do.	do.	1957	U	---	V	Cbs/---
512	4018-7618	Edwin Phillippy	---	1840	U	558	V	Cr/---
513	4018-7618	Moses Lapp	---	1948	H	562	S	Cr/dol
514	4019-7619	Amos Zimmerman	---	1940	H	---	T	Cr/ls
515	4019-7618	A. E. Zimmerman	---	1955	H	---	V	Cr/---
516	4019-7618	William Dibble	---	1945	H	---	V	Cr/---
517	4019-7618	Elam Stoltzfus	---	1947	H	550	H	Cr/dol

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Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (ppg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
---	---	6	---	25	9/57	---	---	---	---	---	Lb- 331
110	---	6	---	39	9/57	---	---	21	850	7.6	332
96	---	6	---	35	7/73	---	.05	21	750	7.0	333
123	24	8	45;96;108; 149	6	3/57	600	100	17	---	7.5	334
8	---	---	---	3	9/57	---	---	16	675	7.2	335
30	---	6	---	18	9/57	---	.01	16	700	7.0	336
22	---	---	---	19	---	6	---	18	700	7.6	337
12	---	---	---	11	8/57	---	---	12	600	7.6	338
120	19	6	---	70	---	18	---	15	650	7.4	339
30	---	---	---	6	9/57	---	---	9	360	7.5	340
350	---	6	---	---	---	15	---	8	340	7.3	341
303	38	6	---	2	7/50	30	.38	9	400	8.4	342
175	---	6	---	---	---	---	---	18	750	7.9	343
50	---	---	---	---	---	---	---	16	620	7.7	344
173	---	6	---	50	---	---	---	14	520	7.4	345
---	---	6	---	---	---	---	---	12	490	7.6	351
276	36	6	---	53	---	11	---	17	610	7.9	352
44	---	6	---	---	---	---	---	17	710	7.8	353
60	---	---	---	23	9/57	---	---	9	425	7.4	358
240	---	6	---	47	9/57	---	---	---	---	---	362
---	---	4	---	89	10/57	---	---	---	---	---	363
500	---	8	---	---	---	350	---	---	---	---	364
515	68	10	---	23	5/47	250	---	17	790	7.2	365
285	42	6	---	14	---	290	---	16	---	---	366
153	103	8	---	40	---	20	---	12	550	8.0	369
83	---	6	---	44	10/57	---	2.1	11	460	8.3	370
53	38	6	---	15	8/46	60	---	21	810	8.4	371
80	---	6	---	7	7/73	---	180	---	---	---	372
230	18	6	---	2	10/57	200	---	14	---	6.8	373
626	37	8	---	18	9/42	75	---	---	---	---	374
535	22	8	---	22	7/42	80	---	---	---	---	375
618	54	8	---	16	1942	---	---	---	---	---	376
204	---	---	---	13	10/57	20	4.2	---	---	---	377
60	---	6	---	10	10/57	3	---	---	---	---	378
105	---	6	---	15	---	20	---	18	740	6.9	380
355	43	8	---	18	5/55	28	.07	14	550	7.2	381
100	---	8	---	29	10/57	300	---	16	620	7.6	382
495	17	6	---	22	11/49	20	---	9	380	7.1	383
148	---	6	---	---	---	---	---	7	280	8.2	384
192	66	6	---	14	6/49	230	---	---	---	---	385
300	6	---	---	---	---	400	---	---	---	---	386
98	55	6	63;72;98	3	9/59	200	13	7	---	8.0	412
660	---	6	32	4	9/59	2	---	---	---	---	413
300	10	---	---	---	---	50	---	---	---	---	423
300	---	---	---	73	10/57	18	.08	---	---	---	429
500	7	8	---	55	1/58	168	.86	---	---	---	430
415	195	6	---	17	---	147	---	---	---	---	431
360	21	6	120;339	42	11/63	150	.95	3	---	6.5	432
200	---	8	---	---	---	60	---	2	---	6.6	433
165	128	8	---	67	---	25	.3	1	---	7.6	434
223	45	6	---	---	---	---	---	---	---	---	435
314	---	6	---	---	---	---	---	---	---	---	436
806	33	6	---	12	8/50	35	.32	15	---	7.3	439
350	124	6	---	28	9/50	28	.30	---	---	7.3	440
250	21	6	---	21	9/50	45	.50	15	---	7.3	441
98	---	6	---	---	---	5	---	4	144	7.0	442
455	49	8	---	40	1940	110	---	10	312	7.8	443
398	52	8	24;40;90; 155;398	35	3/59	122	1.1	7	216	7.0	444
150	32	10	---	13	---	60	.93	---	---	---	445
111	44	6	---	40	3/53	10	.17	2	100	---	467
116	20	6	85;110	---	---	30	1.4	---	---	---	486
140	63	6	130	40	2/58	8	.08	---	---	---	490
151	46	6	70	47	10/59	44	.85	1	---	6.0	493
49	---	---	---	41	7/57	10	---	14	410	8.2	501
247	---	6	---	---	---	10	---	22	650	7.3	502
270	20	6	---	39	8/57	---	.06	---	---	---	503
52	---	---	---	46	---	---	---	---	1060	7.2	504
120	---	6	---	---	---	---	---	17	600	7.2	505
120	---	6	---	30	7/52	---	.01	12	500	7.2	506
405	---	6	---	---	---	---	---	16	420	7.4	507
350	---	6	---	90	---	---	---	16	560	7.2	508
168	40	6	---	40	1957	20	---	18	---	7.4	509
340	---	6	---	90	8/57	---	---	---	---	---	510
215	---	6	---	92	9/57	---	---	---	---	---	511
82	---	---	---	51	7/57	---	24	---	---	---	512
240	---	6	---	---	---	---	---	15	470	7.6	513
120	---	6	---	---	---	---	---	22	900	7.2	514
111	60	6	---	---	---	---	---	9	310	7.6	515
141	---	6	---	30	1945	---	---	14	360	7.5	516
125	62	6	---	54	7/57	---	1.7	22	860	7.3	517

TABLE 9.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 518	4020-7618	Spangler Sch.	---	---	P	527	V	Cr/---
519	4020-7619	H. G. Oeurer	---	1950	H	---	V	Os/---
520	4018-7621	N. P. Oundore	---	---	H	606	V	Csc/dol
521	4017-7620	Harry Sechrist	---	1929	H	518	V	Cbs/ls
522	4018-7619	Irvin Krall	---	---	H	---	V	Cm/---
523	4019-7620	Oaniel Grumbine	Harrisburg's Kohl Bros.	---	H	---	V	Cr/ls
524	4019-7620	Harry Reesor	Jacob G. Wentzel	1954	S	540	H	Cr/dol
525	4019-7620	Henry Royer	Harrisburg's Kohl Bros.	---	H	---	V	Cr/---
526	4020-7620	Amos Balsbaugh	---	---	H	549	S	Os/ls
527	4020-7621	---	Harrisburg's Kohl Bros.	1932	H	---	V	Ori/---
528	4020-7621	Allen Royer	---	---	H	---	S	Oe/---
529	4021-7620	Francis Bicksler	---	---	H	---	V	Oe/---
530	4021-7620	Andrew Mindy	---	---	H	---	V	Oe/---
531	4020-7619	Clyde Oeck	---	---	H	516	S	Os/ls
532	4020-7619	Kline	---	---	H	527	H	Cr/dol
533	4020-7619	I. J. Bollinger	Harrisburg's Kohl Bros.	1942	H	---	V	Cr/---
534	4019-7619	Hilda Balmer	---	---	H	537	S	Cr/dol
535	4019-7617	Howard Weiss	Harrisburg's Kohl Bros.	1953	H	---	V	Cr/---
536	4019-7616	Alfred Schnoke	---	---	H	540	S	Cr/dol
537	4019-7616	P. S. Wenger	Harrisburg's Kohl Bros.	1955	H	---	S	Cr/ls
538	4019-7616	E. H. Weidman	---	---	H	545	S	Cr/dol
539	4020-7615	Martin Weaver	---	---	H	---	V	Cr/---
540	4020-7615	Luther Mathias	---	1953	H	---	S	Cr/---
541	4020-7615	Thomas Peachy	---	---	H	---	V	Cr/---
542	4020-7615	P. C. Martin	---	---	H	515	S	Cr/dol
543	4020-7615	S. E. Z. Erb	Harrisburg's Kohl Bros.	---	H	---	V	Oe/---
544	4021-7616	Emma Getz	---	---	U	442	V	Oe/ls
545	4021-7616	Harold Blecker	---	---	H	477	S	Oe/ls
546	4020-7617	Elco Sch. Oistrict	---	---	U	520	H	Os/ls
547	4020-7618	Hubert Miller	---	---	H	488	S	Os/ls
548	4021-7618	Leon Brubaker	Harrisburg's Kohl Bros.	1955	H	---	V	Ori/---
549	4018-7618	Moses Garman	do.	1933	H	---	V	Cr/---
550	4020-7618	P. B. Horning	---	---	U	514	H	Os/ls
551	4021-7618	Wayne Oubble	---	---	H	---	V	Ori/---
552	4021-7618	Hubert Miller	---	---	H	509	S	Oe/ls
553	4021-7619	Edgar Messerschmidt	---	1938	H	504	V	Ori/dol
554	4021-7619	N. H. Hess	Harrisburg's Kohl Bros.	1941	H	---	V	Ori/---
555	4017-7618	Irvin Kline	do.	1949	H	---	V	Cbs/---
556	4017-7618	do.	---	---	S	---	V	Cbs/---
557	4017-7618	Ferris Eberly	---	---	H	---	S	Csc/---
558	4017-7618	do.	---	---	H	---	V	Csc/---
559	4021-7619	Moses Lapp	---	---	H	537	S	Ori/dol
560	4021-7619	do.	Harrisburg's Kohl Bros.	1947	H	537	H	Ori/---
561	4017-7622	Hannah Binner	---	---	H	---	V	Cbs/---
562	4017-7622	E. W. Longenecker	---	---	H	588	V	Cbs/ls
563	4017-7621	Norman Wenger	---	---	H	565	V	Cbs/---
564	4017-7620	O. Backenstose	---	1920	H	515	V	Cbs/ls
565	4018-7617	J. M. Royer	---	---	H	651	V	Oh/---
566	4018-7617	Arthur Horst	---	---	H	662	V	Oh/---
568	4019-7617	John Horning	---	---	H	---	V	Cr/---
569	4019-7617	do.	---	---	U	577	V	Cr/---
570	4019-7616	Oaniel Horning	---	---	H	567	H	Cr/dol
571	4019-7616	P. S. Martin	---	---	H	---	V	Csc/ls
572	4019-7616	William Krum	---	---	H	---	V	Csc/---
573	4018-7615	Ezra Martin	---	---	H	606	V	Oh/---
574	4017-7619	Landis Martin	---	---	H	---	V	Csc/---
575	4018-7621	G. K. Krall	---	---	H	---	V	Cbs/---
576	4018-7622	A. S. Martin	Harrisburg's Kohl Bros.	---	H	---	V	Cs/---
577	4018-7622	J. A. Ulrich	do.	1930	H	---	V	Cm/---
578	4018-7622	Charles Gingrich	---	---	H	515	V	Cm/---
579	4019-7621	Mark Horst	Jacob G. Wentzel	1956	H	557	H	Cm/ls
580	4020-7621	Roy Bates	Kohl Bros., Inc.	---	H	520	V	Ori/dol
581	4020-7622	J. H. Bennetch	Harrisburg's Kohl Bros.	---	H	---	V	Oe/---
583	4021-7621	G. H. Flowers	---	1932	H	---	V	Oe/---
584	4021-7621	Paul Troutman	---	1952	H	---	V	Ohy/---
585	4021-7621	Calcite Quarry Corp.	C. S. Garber & Sons, Inc.	1956	N	528	V	Ohy/ls
586	4022-7621	Henry Troutman	---	---	H	---	S	Ohy/---
587	4022-7621	E. Loump	---	---	H	542	S	Ohy/ls
588	4021-7621	John Kline	---	---	H	---	V	Ohy/ls
589	4021-7617	J. E. Long	---	---	H	---	S	Oe/---
590	4021-7616	C. W. Becker	---	1955	H	---	V	Oe/---
591	4021-7616	Robert Schultz	Long	---	H	490	S	Oe/ls
592	4022-7615	Lloyd Martin	---	---	H	489	V	Oe/---
593	4022-7615	Arthur Lehman	---	---	H	410	S	Oan/ls
594	4023-7617	Sidney Gingrich	---	---	H	---	V	Ohy/---
595	4022-7617	Oonald Hall	---	---	H	---	S	Omy/---
596	4020-7620	S. A. Herr	---	---	H	554	H	Cr/dol
597	4020-7622	Warren Lentz	---	---	H	534	V	Os/---
598	4017-7618	A. C. Ream	---	---	H	567	S	Cm/ls
599	4018-7618	Allen Krall	---	---	S	---	V	Cr/---
600	4018-7618	do.	---	---	H	532	V	Cr/---
601	4018-7619	Raymond Gibble	---	---	H	543	V	Cm/---
602	4018-7620	Abram Weaver	---	---	H	615	H	Cs/---
603	4018-7620	George Krall	---	---	H	---	V	Cm/---
604	4018-7620	Sally Snyder	Harrisburg's Kohl Bros.	1952	H	---	H	Cr/---
605	4019-7620	Ralph Boyd	---	---	H	---	V	Cr/---
606	4019-7620	S. F. Bomberger	---	---	H	545	H	Cr/dol

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
---	---	6	---	71	7/57	10	20	14	500	7.8	Lb- 518
151	100	6	---	50	---	---	---	14	660	7.4	519
150	---	6	---	64	7/57	---	8	12	380	7.1	520
55	---	6	---	25	1955	---	---	14	490	7.2	521
112	---	6	---	30	7/57	---	---	20	750	7.2	522
70	---	6	---	---	---	---	---	16	550	7.2	523
165	70	6	---	47	7/57	25	1.6	16	510	7.3	524
625	200	6	---	40	---	---	---	16	540	7.1	525
50	---	---	---	27	7/57	---	---	20	690	6.8	526
643	---	6	---	48	---	---	---	24	540	7.1	527
85	---	6	---	---	---	---	---	21	1010	6.8	528
190	---	6	---	---	---	---	---	21	620	7.0	529
125	---	6	---	---	---	---	---	---	630	7.1	530
75	---	---	---	51	7/57	---	---	---	700	7.0	531
140	---	6	---	---	---	---	---	---	610	7.2	532
165	---	6	---	---	---	---	---	---	670	6.9	533
200	---	6	---	41	7/57	---	14	---	750	6.9	534
100	---	6	---	---	---	---	---	---	520	7.3	535
112	---	6	---	45	7/57	---	1.1	---	600	7.2	536
219	---	6	---	---	---	---	---	---	450	7.3	537
170	---	6	---	---	---	---	---	---	475	7.2	538
100	---	6	---	---	---	---	---	---	470	7.0	539
115	6	6	---	95	---	---	---	---	675	7.2	540
120	---	6	---	34	---	---	---	---	790	6.9	541
75	---	6	---	40	7/57	---	33	---	490	7.2	542
77	---	6	---	---	---	---	---	---	1375	7.1	543
36	---	---	---	29	7/57	---	---	---	580	---	544
200	---	6	---	68	9/57	---	9.0	16	640	---	545
120	---	6	---	---	---	---	---	---	1150	7.2	546
---	---	6	---	58	7/57	---	---	---	475	---	547
142	12	6	---	70	---	6	---	---	450	---	548
125	90	6	---	35	---	4	---	---	670	---	549
82	---	---	---	71	7/57	---	---	---	780	---	550
60	---	---	---	8	---	---	---	---	700	---	551
100	---	6	---	14	7/57	---	3.8	---	920	---	552
260	---	6	---	16	7/57	---	150	---	520	---	553
121	7	6	---	65	8/43	---	---	---	590	---	554
334	---	6	---	---	---	1	---	---	575	---	555
50	---	---	---	---	---	---	---	---	1500	---	556
100	---	6	---	---	---	---	---	---	455	---	557
100	---	6	---	---	---	---	---	---	455	---	558
50	---	---	---	27	7/57	---	---	---	740	---	559
300	---	6	---	---	---	4	---	---	550	---	560
88	---	---	---	---	---	---	---	11	350	7.2	561
68	---	---	---	56	7/57	---	2.4	17	800	7.1	562
48	---	---	---	44	7/57	---	---	11	590	6.9	563
35	---	8	---	3	7/57	---	100	15	655	7.3	564
40	---	---	---	13	7/57	---	---	13	560	7.1	565
60	---	---	---	8	7/57	---	---	5	165	7.0	566
180	---	6	---	---	---	---	---	23	810	7.2	568
60	---	---	---	36	7/57	---	.01	---	---	---	569
72	---	6	---	497	8/57	---	---	18	690	7.2	570
100	---	6	---	---	---	---	---	16	580	7.3	571
181	---	6	---	---	---	---	---	24	815	7.2	572
23	---	---	---	18	7/57	---	---	7	270	6.9	573
20	---	---	---	---	---	---	---	13	480	7.4	574
40	---	---	---	12	---	---	---	17	700	7.1	575
137	---	6	---	---	---	---	---	17	740	7.2	576
135	---	6	---	50	---	---	---	11	440	7.2	577
95	---	6	---	40	8/57	---	100	13	555	7.2	578
152	51	6	---	---	---	---	---	13	470	7.3	579
135	---	6	---	---	---	---	---	14	710	7.0	580
100	---	6	---	---	---	---	---	17	700	7.1	581
103	---	6	---	---	---	---	---	26	1275	7.2	583
130	---	6	---	90	---	---	---	16	650	7.2	584
---	---	6	---	21	8/57	---	---	18	580	7.3	585
21	---	---	---	7	---	---	---	9	360	7.0	586
13	---	---	---	6	1957	---	---	14	545	7.1	587
80	---	6	---	41	---	---	---	20	975	7.2	588
30	---	---	---	26	---	---	---	18	660	7.0	589
75	---	6	---	55	---	---	---	18	640	7.1	590
100	---	6	---	---	---	---	---	15	630	7.2	591
80	---	---	---	64	8/57	---	---	19	660	7.4	592
40	---	6	---	22	1957	---	---	14	510	7.1	593
100	---	6	---	---	---	---	---	22	850	7.0	594
30	---	---	---	---	---	---	---	19	670	7.0	595
65	---	---	---	54	8/57	---	7.4	14	475	7.3	596
366	---	6	---	61	8/57	---	10	15	500	7.5	597
45	---	---	---	28	8/57	---	---	11	460	7.2	598
200	---	6	---	---	---	---	---	14	575	7.3	599
60	---	---	---	18	8/57	---	---	14	545	7.3	600
40	---	---	---	34	8/57	---	100	13	480	7.4	601
30	---	---	---	17	8/57	---	---	20	750	7.2	602
45	---	---	---	---	---	---	---	20	800	7.1	603
800	25	6	---	40	---	3	---	19	740	7.3	604
90	---	6	---	38	---	---	---	17	750	7.0	605
170	---	6	---	60	8/57	---	---	14	550	---	606

TABLE 9.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/lithology
Number	Lat-Long							
Lb- 607	4019-7622	Stanley Smith	---	---	H	---	V	Cr/---
608	4019-7622	J. R. Blouser	Harrisburg's Kohl Bros.	1957	H	---	T	Cm/---
609	4020-7620	George Vogt	do.	---	H	---	S	Os/---
610	4020-7620	do.	---	---	H	---	S	Os/---
611	4016-7622	Mark Heisley	---	---	H	649	S	Cbs/---
612	4016-7622	do.	---	---	S	660	S	Trhss/ss
613	4016-7621	Donald Walters	---	---	H	680	V	Trhss/ss
614	4017-7620	Henry Patches	---	---	H	---	V	Cbs/---
615	4016-7618	Harry Boyer	---	---	H	505	V	Trhss/cg
616	4017-7619	Lizzie Meyer	Harrisburg's Kohl Bros.	1915	H	---	S	Cbs/---
617	4018-7618	J. Z. Lapp	---	---	H	561	V	Cr/---
618	4018-7618	Ammon Fisher	---	---	H	---	S	Cr/---
619	4018-7617	Isaac Zook	Harrisburg's Kohl Bros.	---	H	---	S	Cr/---
620	4019-7617	Sally Krall	---	---	H	---	S	Cr/---
621	4020-7615	P. M. Zimmerman	---	---	H	505	S	Ori/dol
622	4017-7620	Mark Bomberger	---	---	H	---	V	Cbs/---
623	4018-7620	Arthur Krall	---	1954	H	---	V	Csc/---
624	4020-7619	Warren Krall	---	---	H	---	H	Cr/---
625	4021-7619	L. W. Phillippy	---	---	H	505	H	Oe/ls
626	4021-7619	Walter Peiffer	---	---	U	465	V	Oe/ls
627	4021-7619	Tillie Oonmoyer	---	---	I	457	V	Oo/---
628	4022-7619	Jesse Gingrich	---	---	H	498	V	Omy/---
629	4022-7620	Ben Oow	---	---	H	539	S	Oh8/---
630	4022-7620	Jacob Lentz	---	---	H	528	S	Ohy/ls
631	4022-7620	H. C. Umbenhauer	---	---	H	483	V	Ohy/ls
632	4021-7620	Norman Weaver	---	---	H	506	V	Ohy/ls
633	4022-7621	Perry Sanger	---	---	H	---	V	Ohy/---
634	4022-7620	M. Burkholder	---	---	S	---	V	Ohy/---
635	4022-7618	R. H. Kreiser	---	---	H	460	V	Oo/dol
636	4021-7618	Myerstown Hide & Tallow Co.	Harrisburg's Kohl Bros.	---	U	---	V	Oe/---
637	4020-7618	O. M. Lapp	---	---	H	---	S	Cr/---
638	4022-7617	Jacob Mase	---	---	H	---	V	Oan/---
639	4022-7616	David Ressler	---	---	H	---	H	Omy/---
640	4022-7616	S. G. Horning	Harrisburg's Kohl Bros.	---	H	---	S	Omy/---
641	4022-7616	Melvin Huber	Elias Gessart	---	H	457	S	Omy/ls
642	4022-7616	do.	do.	---	U	457	S	Omy/ls
643	4022-7616	Oavid Ressler	Harrisburg's Kohl Bros.	---	H	---	S	Oan/---
644	4021-7616	do.	do.	---	H	---	V	Oan/---
645	4020-7616	Benjamin Hartman	---	---	H	---	V	Os/---
646	4020-7616	C. R. Sechrist	---	---	H	---	V	Os/---
647	4020-7617	Victor Ziegler	---	---	S	---	H	Cr/---
648	4020-7617	Norman Martin	---	---	H	---	V	Os/---
649	4021-7617	J. Z. Martin	---	---	H	---	V	Oe/---
650	4021-7619	J. R. Kreider	---	---	U	458	V	Oo/dol
651	4022-7615	Annie Stutzman	---	---	H	---	V	Ori/---
653	4023-7618	Myerstown Mennonite Ch.	Harrisburg's Kohl Bros.	1957	T	---	H	Ohy/---
654	4023-7617	J. P. Troutman	---	---	H	508	S	Ohy/ls
655	4023-7617	Paul Lehman	---	---	H	---	V	Ohy/---
656	4023-7618	Harry Sattazahn	---	---	H	663	V	Oh8/---
658	4020-7621	Eugene Peiffer	---	---	H	---	S	Oe/---
659	4016-7632	Chester Smith	---	---	H	452	V	Csc/---
660	4016-7631	Roy Bowman	---	---	---	510	S	Csc/dol
661	4016-7630	Ezra Hackman	---	---	H	525	V	Csc/---
662	4019-7631	Warren Light	---	---	H	427	V	Oe/---
663	4019-7631	Samuel Fernsler	Kohl Bros., Inc.	1943	H	403	V	Oe/ls
664	4018-7632	Ira Outweiler	---	---	U	482	V	Os/---
665	4017-7632	Earl Weidler	---	---	H	459	V	Os/---
666	4018-7632	Isaac Burkholder	---	---	H	441	V	Oe/---
667	4019-7632	Millard Lime & Stone Co.	---	---	H	426	V	Oe/---
668	4018-7632	Howard Kreider	---	---	U	421	V	Oe/---
669	4018-7633	do.	---	---	H	---	H	Os/---
670	4019-7630	Vernon Swope	---	1935	H	433	V	Oe/---
671	4018-7630	Ralph Sellers	---	1954	S	431	V	Cr/---
672	4020-7631	Howard Kreider	---	---	H	480	V	Oh8/---
673	4016-7631	Elvin Miller	---	---	H	496	V	Csc/---
674	4016-7630	Paul Bomgardner	Harrisburg's Kohl Bros.	1951	H	---	V	Csc/---
675	4019-7622	Keller & Smith	Myers Bros. Orilling Contractors	1959	U	556	C	Cm/ls
676	4019-7632	Millard Lime & Stone Co.	---	---	U	372	V	Oh8/---
679	4019-7634	do.	---	1954	H	508	V	Ohyb/---
680	4019-7635	do.	---	1938	H	510	V	Ohyb/---
681	4019-7633	Marlin Hauer	---	---	H	415	V	Oo/---
682	4019-7633	Millard Lime & Stone Co.	---	1954	---	---	V	Oo/---
683	4019-7634	do.	---	1957	H	---	V	Ohyb/---
685	4021-7621	Calcite Quarry Corp.	---	---	N	498	S	Oo/dol
686	4019-7622	Ferndale Farms	---	---	U	---	V	Cr/---
687	4020-7625	City of Lebanon	Harrisburg's Kohl Bros.	1959	P	---	V	Oe/---
688	4022-7617	Earl Lutz	Kohl Bros., Inc.	1959	U	502	H	Omy/ls
689	4020-7625	City of Lebanon	Harrisburg's Kohl Bros.	1959	P	---	V	Oe/---
690	4019-7625	Triangle Car Wash	---	1959	C	---	V	Os/---
692	4018-7619	Jonas Lapp	---	1959	H	---	V	Cr/---
693	4018-7626	Lester Spitler	---	---	H	---	V	Os/---
694	4018-7631	Paul Wampler	---	1960	H	---	V	Oe/---
695	4018-7627	Wilmer Ziegler	Harrisburg's Kohl Bros.	1945	S	---	V	Os/---
696	4020-7618	Oavid Horning	---	1960	S	---	V	Os/---
697	4020-7617	Elco Sch. Oistrict	Kohl Bros., Inc.	1960	T	519	H	Os/---
698	4020-7617	do.	do.	1960	T	517	H	Os/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
100	---	6	---	---	---	---	---	14	500	7.3	Lb- 607
95	---	6	---	---	---	---	---	10	380	7.3	608
125	---	6	---	---	---	---	---	18	640	7.2	609
142	---	6	---	---	---	---	---	14	560	6.9	610
30	---	---	---	24	8/57	---	2.3	14	640	7.3	611
15	---	---	---	10	8/57	---	---	12	550	---	612
30	---	---	---	26	8/57	---	---	---	200	6.9	613
36	---	---	---	30	8/57	---	---	---	460	7.4	614
32	27	6	---	29	8/57	---	---	---	220	---	615
101	---	6	---	---	---	---	---	---	650	7.3	616
80	---	---	---	57	8/57	---	---	---	475	7.3	617
70	---	---	---	40	---	---	---	---	525	7.3	618
100	---	6	---	40	---	---	---	---	500	7.3	619
57	---	---	---	43	---	4	---	---	450	7.3	620
300	---	6	---	20	8/57	30	---	---	495	7.5	621
58	---	---	---	51	---	---	---	---	590	7.0	622
195	18	6	---	70	---	---	---	---	545	7.2	623
157	---	6	---	50	---	---	---	---	500	7.3	624
300	---	6	---	---	---	---	---	---	610	7.5	625
100	---	6	---	16	7/73	---	---	---	850	7.1	626
100	---	6	---	16	8/57	---	---	---	1010	7.5	627
80	---	---	---	19	8/57	---	---	---	475	7.2	628
14	---	---	---	8	8/57	---	---	---	375	---	629
40	---	---	---	21	8/57	---	---	---	560	7.0	630
80	---	6	---	---	---	---	.44	---	710	7.5	631
100	---	6	---	40	8/57	---	.18	---	650	7.3	632
20	---	---	---	16	---	---	---	---	390	7.0	633
100	---	---	---	---	---	---	---	---	620	7.3	634
50	---	6	---	---	---	---	---	---	695	7.1	635
485	---	6	---	---	---	---	---	---	625	7.3	636
100	---	---	---	50	---	---	---	---	375	7.8	637
100	---	6	---	---	---	---	---	---	580	7.3	638
200	---	6	---	---	---	---	---	---	695	7.0	639
100	---	6	---	---	---	---	---	---	560	7.3	640
116	101	6	---	---	---	---	---	---	485	7.3	641
125	20	6	---	42	8/57	---	11	---	---	---	642
500	---	6	---	---	---	---	---	---	705	7.2	643
200	---	6	---	40	8/57	---	---	---	740	7.5	644
30	---	---	---	14	---	---	---	---	695	7.1	645
200	---	6	---	---	---	---	---	---	610	---	646
75	---	6	---	58	8/57	---	---	---	480	---	647
177	---	6	---	50	---	---	---	---	900	---	648
100	---	6	---	---	---	---	---	---	850	---	649
9	---	---	---	7	7/73	---	---	---	650	---	650
100	---	6	---	---	---	---	---	---	700	---	651
90	36	6	50	15	---	25	---	---	490	7.7	653
100	---	6	---	---	---	---	---	---	650	---	654
100	---	---	---	20	---	---	---	---	390	6.4	655
42	---	---	---	36	8/57	---	---	---	45	5.2	656
---	---	---	---	---	---	---	---	---	740	---	658
100	---	---	---	33	8/59	---	120	---	280	7.6	659
60	---	---	---	---	---	---	---	20	750	7.2	660
280	---	---	---	64	7/59	---	150	---	490	7.0	661
100	---	---	---	48	7/59	---	.35	---	660	7.5	662
42	14	6	---	23	7/59	---	---	15	640	---	663
82	---	---	---	69	7/59	---	---	---	---	---	664
180	---	---	---	45	7/59	---	.15	---	400	---	665
---	---	---	---	67	7/59	---	.23	---	690	---	666
---	---	---	---	48	7/59	---	---	---	---	---	667
---	---	8	---	28	7/59	---	---	---	---	---	668
---	---	6	---	22	7/59	---	3.5	---	470	---	669
150	---	6	---	38	7/59	---	2.5	---	840	---	670
74	64	6	---	20	7/59	---	91	---	550	---	671
16	---	---	---	12	8/59	---	---	---	360	---	672
91	---	6	---	24	8/59	---	1.2	---	940	---	673
209	55	6	---	72	9/57	---	---	---	670	---	674
205	36	6	---	84	8/59	---	---	---	---	---	675
24	---	6	---	9	8/59	---	---	---	---	---	676
110	75	6	---	60	8/59	---	---	---	2300	---	679
161	---	6	---	8	8/59	---	---	---	230	---	680
365	30	6	---	82	8/59	---	73	---	640	---	681
450	10	6	---	123	8/59	---	---	---	---	---	682
225	---	6	---	130	---	---	---	---	---	---	683
265	80	8	---	149	8/59	200	14	14	625	---	685
195	---	6	---	27	9/59	---	---	---	---	---	686
110	43	10	70;110	16	1/60	---	---	---	---	7.5	687
250	---	6	26;189	57	1/60	---	12	---	---	---	688
115	36	8	90	16	1/60	---	---	---	---	---	689
96	---	---	---	27	1/60	---	---	---	---	---	690
232	73	6	---	62	6/60	---	---	---	---	---	692
100	---	6	---	39	6/60	---	52	---	---	---	693
70	37	6	---	39	9/60	---	8.5	---	---	---	694
110	---	6	---	45	9/60	---	.16	---	---	---	695
160	18	6	---	66	9/60	---	---	---	---	---	696
400	59	8	57;200;330	---	8/64	10	.07	---	---	---	697
400	31	8	70;110;200; 305	50	11/60	17	.14	---	---	---	698

TABLE 9.

Well location		Owner	Oriller	Oate completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 699	4020-7611	Newmanstown Water Co.	Kohl Bros., Inc.	1963	P	680	S	Cha/---
700	4019-7612	Richland Bor.	---	---	P	820	S	Cha/---
701	4019-7612	do.	Kohl Bros., Inc.	1942	P	760	S	Cha/---
702	4019-7612	do.	do.	1959	P	880	S	Cha/ss
703	4023-7620	Myerstown Bor.	do.	1949	P	530	V	Oh8/ls
704	4021-7618	Sterling Drug, Inc.	do.	1953	N	465	V	Oo/dol
705	4023-7620	Myerstown Bor.	do.	1951	P	530	V	Oh8/ls
707	4023-7618	do.	do.	1963	U	725	V	Oh8/ls
708	4023-7618	do.	do.	1964	U	720	V	Oh8/ls
709	4023-7618	do.	do.	---	U	725	V	Oh8/ls
710	4019-7615	J. H. Bennetch	do.	1964	H	484	V	Cm/ls
712	4022-7614	Weaver Gehman	do.	1957	H	490	S	Oe/ls
713	4016-7619	Michter's Oistillery, Inc.	do.	1960	N	480	V	Trhss/cg
716	4020-7617	Elco 5ch. Oistrict	do.	1962	U	512	H	Os/ls
717	4020-7617	do.	do.	1962	I	502	S	Os/ls
718	4031-7629	George Hoover	---	---	H	550	V	Dmh/sh
719	4023-7628	S. M. 5oss	---	1938	H	460	V	Oh6/sh
720	4016-7635	H. L. Zeiger	Edwin Gerlach & 5ons	1960	H	500	S	Trhss/ss
722	4021-7618	Sterling Orug, Inc.	Kohl Bros., Inc.	1948	U	460	V	Oo/dol
723	4020-7611	Womelsdorf-Robesonia Joint Authority	do.	1931	P	620	S	Clv/dol
724	4016-7619	Michter's Oistillery, Inc.	do.	1946	N	490	V	Trhss/cg
725	4016-7619	do.	do.	1944	N	495	V	Trhss/cg
727	4025-7621	Ira Yiengst	do.	1938	H	455	V	Oh2/ls
728	4027-7630	L. Neidig	---	---	H	420	V	Oh1/sh
729	4013-7630	Trinity Lutheran Ch.	---	---	H	500	V	Trhss/ss
732	4021-7619	Whitmoyer Laboratories	---	---	U	458	V	Oo/dol
762	4021-7621	do.	Kohl 8ros., Inc.	1968	S	502	H	Oe/ls
763	4022-7618	Merton Harding	do.	1951	U	460	S	Omy/ls
764	4022-7618	Goodwill Fire Co. #1	do.	1946	A	480	S	Ohy/ls
765	4022-7618	Harold Miller	do.	1966	C	450	V	Oan/ls
766	4023-7618	W. H. 5hirk	do.	1951	H	522	S	Ohy/ls
767	4023-7617	Outch-Way Farm Market	Myers 8ros. Orilling Contractors	1972	C	490	S	Ohy/ls
768	4023-7617	Oavid Martin	---	---	S	490	S	Ohy/ls
769	4022-7615	Lloyd Martin	Kohl Bros., Inc.	1966	S	481	S	Oe/ls
770	4022-7617	Jacob Mays	---	---	H	435	V	Oan/ls
772	4022-7617	Allen Holtzman	Uriah Myers	1922	H	435	V	Oan/ls
773	4022-7617	do.	---	---	H	435	V	Oo/dol
774	4022-7616	Annie Weaver	---	---	H	425	V	Oan/ls
776	4022-7616	Bethlehem Mines Corp.	---	---	C	430	V	Omy/ls
777	4022-7616	W. N. Heydt	Kohl 8ros., Inc.	1950	H	420	V	Oo/dol
779	4022-7618	Carl Wenger	do.	---	H	450	V	Oan/ls
782	4022-7618	Richard Eiceman	do.	1952	H	455	V	Oo/dol
783	4021-7619	Quaker Alloy Casting Co.	do.	1960	N	500	S	Oe/ls
784	4021-7619	John Gibble	---	---	H	488	S	Oe/ls
785	4022-7619	William Moore	Kohl 8ros., Inc.	1964	I	482	S	Oan/ls
787	4021-7618	H. S. Miller	Harrisburg's Kohl Bros.	1966	H	502	S	Oe/ls
788	4017-7617	Heidelberg Water Co.	Kohl 8ros., Inc.	1962	P	610	V	Trhss/ss
793	4014-7627	Mt. Gretna Heights Water Co.	do.	1966	P	810	S	Trhss/ss
794	4014-7628	Mt. Gretna Camp Meeting Assn.	Harrisburg's Kohl 8ros.	1967	P	720	S	Trhss/ss
795	4014-7627	Pa. Chautauqua	---	1913	P	845	H	Trhss/cg
796	4014-7628	do.	---	1905	P	640	V	Trhss/ss
797	4014-7628	do.	Kohl Bros., Inc.	1966	P	650	S	Trhss/ss
798	4015-7634	Campbelltown Water Co.	do.	1973	P	560	V	Trhss/ss
799	4016-7634	do.	Gassert	---	P	540	S	Trhss/ss
800	4014-7628	Conewago Hills, Inc.	---	1952	P	645	S	Trhss/cg
801	4017-7615	G. F. Gingrich	Kohl Bros., Inc.	1966	H	695	S	Trhss/ss
802	4017-7615	W. M. Smith	do.	1969	H	640	S	Trhss/ss
803	4016-7616	Paul Eubanks	do.	1969	H	880	H	Trhss/ss
804	4016-7617	Edwin Stauffer	do.	1968	H	558	V	Trhss/ss
805	4017-7617	Heidelberg Sportsman's Club	do.	1968	C	620	S	Trhss/cg
806	4016-7618	Louis Spurigo	do.	1970	H	590	H	Trhss/ss
807	4016-7618	Paul Sweigart	do.	1968	H	620	S	Trhss/ss
808	4015-7618	O. J. Beard	do.	1970	H	640	S	Trhss/ss
809	4016-7622	Arlene Krick	Fisher's Well Orilling	1974	H	760	S	Trd/db
810	4017-7614	H. E. Fertig	Kohl 8ros., Inc.	1969	H	600	S	Trhss/ss
811	4017-7613	Monroe Lesher	do.	1967	H	780	H	Trhss/ss
812	4015-7623	Robert Groh	do.	1971	H	860	S	Trhss/cg
813	4015-7623	Penn Laurel Council, Inc.	do.	1965	H	930	S	Trhss/cg
814	4015-7623	Bethlehem Steel	Ridpath & Potter, Inc.	1921	U	690	S	Trhss/ss
815	4016-7624	do.	do.	1921	U	620	V	Oh/---
816	4015-7626	Gretna Glen	Kohl 8ros., Inc.	1973	H	680	S	Trd/db
817	4015-7627	W. E. Haag	do.	1971	H	740	V	Trhss/ss
818	4015-7626	Lamar Stutzman	do.	1967	H	740	S	Trhss/ss
819	4015-7627	M. R. Oemlinger, Jr.	do.	1964	H	760	S	Trd/db
820	4015-7627	John Thomas	do.	1969	H	770	S	Trhss/ss
821	4015-7628	A. G. Black	do.	1963	H	740	H	Trhss/ss

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
212	40	6	92;140;190	---	10/63	35	.35	---	---	---	Lb- 699
310	200	6	---	---	---	---	---	---	---	---	700
548	367	6	---	162	6/42	---	---	---	---	---	701
678	152	6	18;38;205	5	2/59	60	.41	---	---	---	702
165	139	6	---	8	11/49	200	14	---	---	---	703
208	82	8	---	25	2/53	750	---	---	---	---	704
200	112	8	---	8	10/51	400	21	---	---	---	705
255	104	6	56;88;142; 255	---	---	575	---	---	---	---	707
220	40	6	90;115;150; 165;170	22	6/64	350	---	---	---	---	708
100	---	---	---	---	---	---	---	---	---	---	709
118	21	6	45;76	8	4/64	100	.91	---	---	---	710
295	27	6	145;285	84	8/57	10	10	---	---	---	712
485	60	8	32;67;168; 337;445	13	6/60	235	3.1	12	400	---	713
545	72	6	90;322;540	52	8/62	5	.03	---	---	---	716
385	114	6	60;370	54	8/62	25	.26	---	---	---	717
125	---	---	---	---	---	---	---	1	35	5.8	718
48	---	6	---	---	---	---	---	3	170	6.5	719
107	60	6	---	---	---	21	---	7	265	6.9	720
194	26	8	---	25	12/48	660	330	---	---	---	722
360	---	---	---	---	---	300	---	6	210	---	723
345	51	8	80;258	30	8/46	237	---	---	---	---	724
243	18	8	---	12	8/44	240	---	---	---	---	725
66	18	6	---	---	---	---	---	17	593	---	727
---	---	6	---	---	---	---	---	9	355	---	728
100	---	6	---	17	8/63	7	.58	6	240	---	729
29	---	6	---	5	7/73	---	19	---	---	---	732
140	91	6	112;127	61	7/73	100	1.3	---	---	---	762
90	13	6	---	23	7/73	---	---	---	---	---	763
174	38	6	---	12	7/73	---	---	---	---	---	764
145	49	6	---	10	7/73	100	12	---	---	---	765
138	37	6	---	9	7/73	8	.12	---	---	---	766
300	---	6	---	---	---	6	---	---	---	---	767
125	---	6	---	37	7/73	20	---	---	---	---	768
200	82	6	103,196	53	7/73	20	.16	---	---	---	769
77	---	6	---	8	7/73	---	---	---	---	---	770
250	---	10	---	4	7/73	200	---	---	---	---	772
20	---	---	---	---	---	---	---	---	---	---	773
22	---	---	---	15	7/73	---	---	---	---	---	774
165	---	6	---	24	7/73	---	---	---	---	---	776
53	38	6	---	37	7/50	30	---	---	---	---	777
---	---	6	---	---	---	---	---	---	---	---	779
200	29	6	---	20	3/52	11	---	---	---	---	782
470	18	6	---	70	7/60	20	.67	---	---	---	783
185	---	6	---	---	---	---	---	---	---	---	784
230	20	6	80;114;220	37	7/73	30	.21	---	---	---	785
448	20	6	200;218	67	7/73	3	.01	---	---	---	787
110	44	6	50;73;102;106	14	9/62	200	12	7	---	7.9	788
140	88	6	101;123;137	44	4/66	210	42	1	---	6.2	793
210	29	6	17;102;201	6	10/67	87	.93	3	---	7.0	794
261	---	8	---	---	---	20	---	2	40	6.0	795
320	37	8	---	8	11/75	---	---	---	---	---	796
385	41	6	72;140;190; 270;320	40	10/66	90	.75	2	---	6.4	797
300	64	6	80;93;124;171	6	8/73	167	1.2	5	165	6.8	798
400	---	8	---	---	---	30	---	---	---	---	799
200	---	6	---	60	1967	45	.65	---	---	---	800
100	26	6	49;71	65	10/66	30	2.0	2	50	---	801
58	42	6	47;56	28	12/69	30	1.0	3	175	---	802
280	34	6	209;268;278	140	10/75	60	.52	2	90	---	803
100	27	6	53;71;94	18	1/68	80	.98	5	260	---	804
140	44	6	72;128	38	3/68	40	.39	---	---	---	805
115	41	6	70;80;95	40	9/70	30	.50	6	315	---	806
140	22	6	51;109	47	3/68	15	.16	5	195	---	807
120	42	6	67;114	43	11/70	20	.30	3	135	---	808
301	50	6	176;262	---	---	1	---	---	---	---	809
98	41	6	60;76;93	18	9/69	15	.18	7	300	---	810
280	111	6	273	44	9/67	15	.06	10	325	---	811
158	53	6	84;102;134	45	9/71	45	.43	2	60	---	812
175	52	6	102;145;170	58	5/65	30	1.4	---	---	---	813
731	---	12	---	---	---	66	---	---	---	---	814
501	---	12	---	12	6/21	150	5.2	---	---	---	815
360	22	6	142;360	15	11/73	1	.01	6	215	---	816
74	42	6	55;72	35	11/71	30	.77	2	60	---	817
60	35	6	46;54	34	7/67	15	.58	---	---	---	818
220	21	6	80;176	60	9/64	6	.04	---	---	---	819
98	69	6	75;91	46	4/69	100	1.9	2	90	---	820
160	41	6	121;149;153	86	5/69	20	.27	---	---	---	821

TABLE 9.

Well location		Owner	Oriller	Oate completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 822	401S-7629	Walter Elliot	Kohl 8ros., 1nc.	1964	H	620	V	Trhss/ss
823	4015-7628	Ronald Oitzler	do.	1970	H	680	5	Trhss/ss
824	4015-7628	G. W. Zentz	do.	1974	H	650	V	Trhss/ss
825	4014-7629	Roland Nissley	do.	1971	H	700	H	Trhss/ss
826	4014-7629	Timber 5ervice Co.	---	1888	P	725	H	Trhss/ss
827	401S-7635	Herman Hartman	Rufus A. Light	1969	H	545	5	Trhss/ss
828	4016-7634	P. W. Heisey	Kohl Bros., 1nc.	1973	H	555	5	Trhss/ss
829	401S-7634	Oarwin Heisey	do.	1971	H	560	5	Trhss/cg
830	4015-7634	5pring Creek Ch.	Harrisburg's Kohl 8ros.	1971	H	675	H	Trhss/ss
831	4014-7633	Melvin Siegrist	Kohl Bros., Inc.	1973	H	560	5	Trd/db
832	4015-7634	Michael Hugendubler	Harrisburg's Kohl 8ros.	1971	H	600	5	Trhss/ss
833	401S-7633	R. M. Theiler	Rufus A. Light	1971	H	575	5	Trhss/ss
834	401S-7633	Henry Sell	Kohl Bros., Inc.	1968	H	580	S	Trhss/ss
835	4015-7633	Bruce Long	do.	1968	H	580	5	Trhss/ss
836	401S-7632	H. W. 5harr	do.	1967	H	570	V	Trd/db
837	401S-7632	G. C. Bowman, Jr.	do.	1967	H	700	H	Trhss/ss
838	4016-7631	H. J. Oeck	do.	1967	U	545	5	Trd/db
839	4016-7631	Oeck Acres Camp Ground	do.	1971	C	685	S	Trhss/ss
840	4015-7631	1van Beare	Rufus A. Light	1968	H	740	S	Trhss/cg
841	4015-7631	Henry Gilbert	do.	1968	H	760	H	Trhss/ss
842	401S-763S	Mike Mavretic	Harrisburg's Kohl Bros.	1973	H	650	5	Trhss/ss
843	4013-7633	Nevin Kern	Kohl Bros., Inc.	1958	H	460	V	Trhss/sh
844	4013-7634	E. E. Coughenour	do.	1971	H	505	V	Trhss/sh
845	4013-7633	Raymond Smith	Harrisburg's Kohl 8ros.	1970	H	460	V	Trhss/sh
846	4012-7602	M. H. Geib	Kohl Bros., Inc.	1960	H	470	S	Trhss/ss
847	4014-7631	Pa. Game Comm.	Harrisburg's Kohl Bros.	196S	H	500	V	Trhss/ss
848	4014-7632	Colebrook United Ch. of Christ	Kohl Bros., Inc.	1971	H	540	H	Trhss/sh
849	401S-7631	Camp Kirchenwald	do.	1967	T	600	5	Trhss/ss
850	4016-7631	do.	do.	197S	T	590	S	Trhss/ss
851	4014-7630	Christine Shuman	do.	1968	H	53S	V	Trhss/ss
852	4014-7630	Frederick Morrisey	do.	1963	H	520	V	Trd/db
853	4015-7630	Norman Oaub	do.	1960	H	650	S	Trhss/cg
854	4014-7626	Carlos R. Leffler, Inc.	do.	1972	C	740	5	Trhss/cg
855	4014-7626	do.	do.	1962	U	750	H	Trhss/cg
890	4020-7629	M. Long	Fisher's Well Orilling	1978	H	555	5	Oh8/ls
891	4020-7629	B. Lingle	Kohl Bros., Inc.	1978	H	520	5	Oh8/sh
892	4021-7629	J. Centini	Myers Bros. Orilling Contractors	1979	H	560	S	Oh8/sh
893	4022-7627	R. Kohr	Carson Bros.	1978	H	570	S	Oh8/sh
894	4021-7628	J. Steckbeck	Rufus A. Light	1977	H	470	V	Oh8/---
895	4022-762S	B. Heilman	Myers Bros. Orilling Contractors	1979	H	660	H	Oh8/sh
896	4022-7623	Larry Hentz	do.	1976	H	645	H	Oh8/sh
897	4021-7622	O. Warholic	Fisher's Well Orilling	1979	H	600	H	Oh8/sh
898	4022-7628	T. Rowe	Kohl Bros., Inc.	1978	H	500	5	Oh6/---
899	4022-7628	J. Cantrell	Fisher's Well Orilling	1978	H	495	S	Oh6/---
900	4023-7628	J. Smith	Kohl Bros., Inc.	1976	H	520	5	Oh6/---
901	4021-7625	J. Minnich	Fisher's Well Drilling	1978	H	560	S	Oh8/sh
902	4023-7628	Arlene Graby	Myers Bros. Orilling Contractors	1976	H	540	5	Oh6/---
903	4023-7628	James Gillmore	do.	1977	H	540	5	Oh6/---
904	4025-7625	F. Solesky	John Thran	1978	H	465	S	Oh3/sh
905	4024-762S	E. Weaver	Myers Bros. Orilling Contractors	1979	S	45S	5	Oh6/sh
906	4025-7623	Wolfe's Meetinghouse	Kohl Bros., Inc.	1977	H	480	S	Oh2/ls
907	4026-7623	Karl Edris	Fisher's Well Orilling	1979	H	485	5	Oh2/ls
908	4026-7624	Richard Hummel	do.	1977	H	545	H	Oh3/---
909	4026-7624	J. O. 5wartz	Myers Bros. Orilling Contractors	1976	H	535	S	Oh3/sh
910	4027-7626	John Pajski	Walter Knies	1976	H	550	5	Oh1/sh
911	4022-7621	M. Shay	Myers Bros. Orilling Contractors	1978	H	670	H	Oh8/sh
912	4023-7621	5. Eckert	do.	1978	H	645	5	Oh8/sh
913	4024-7620	E. Lapp	do.	1979	H	625	S	Oh8/sh
914	4024-7620	W. Buck	Fisher's Well Orilling	1979	S	630	S	Oh8/---
915	4024-7618	J. Longenecker	Myers Bros. Orilling Contractors	1977	H	710	H	Oh8/sh
916	4024-7617	R. Sheck	Fisher's Well Orilling	1978	H	650	5	Oh8/---
917	4023-7617	J. Stoltzfuss	do.	1978	H	495	V	Ohy/---
918	4023-7621	C. Springborn	Henry Schissler	1978	H	640	5	Oh8/---
919	4022-7620	G. Gettler	Fisher's Well Orilling	1979	H	540	S	Oh8/ls
920	4023-7618	O. Stonesifer	Kohl 8ros., Inc.	1978	H	580	5	Oh8/---
921	4024-7619	R. Alwine	Myers Bros. Orilling Contractors	1979	H	670	H	Oh8/---
922	4023-7619	F. Kline	Kohl Bros., Inc.	1978	H	630	S	Oh8/---
923	4025-7622	J. Hess	Myers Bros. Orilling Contractors	1978	H	475	5	Oh6/sh
924	4024-7622	N. Gingrich	do.	1978	S	505	V	Oh6/sh
925	4023-762S	I. Steiner	Walter G. Butler	1978	H	460	V	Oh6/---
926	4023-7623	C. Weiant	Myers Bros. Orilling Contractors	1978	H	530	5	Oh6/sh
927	4028-7624	5. Geesaman	do.	1979	H	580	5	Oh1/sh

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (ppg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
75	42	6	55;70	21	5/64	50	1.0	2	60	---	Lb- 822
140	43	6	80;123;136	48	11/75	30	.39	2	45	---	823
180	42	6	87;118;164	17	5/74	30	.18	5	165	---	824
220	62	6	178;196;210	85	6/71	30	.26	4	130	---	825
800	---	8	---	102	11/75	22	1.6	---	160	---	826
133	81	6	90;129	56	3/69	10	.16	1	40	---	827
135	42	6	54;72;110	35	9/76	30	.33	4	210	---	828
120	42	6	61;106	47	3/71	20	.27	---	---	---	829
100	60	6	70;90	55	11/71	15	.33	3	115	---	830
195	41	6	52;116;154; 170	41	9/76	8	.05	5	215	---	831
90	40	6	60;80	25	11/71	15	.23	---	---	---	832
78	48	6	58;72;77	20	3/71	20	.53	11	450	---	833
100	30	6	43;61;89	16	10/68	40	.53	2	90	---	834
75	41	6	46;52;68	1	6/68	50	.73	---	---	---	835
200	29	6	40;155	95	9/67	2	.01	5	250	---	836
158	51	6	55;80;110;150	50	9/67	30	.30	1	55	---	837
300	21	6	210	4	9/76	5	.02	---	---	---	838
100	52	6	59;88	34	8/71	60	1.1	2	75	---	839
67	60	6	40;54;67	37	5/68	15	---	5	280	---	840
66	61	6	61	50	7/68	12	---	---	---	---	841
120	63	6	63	35	5/73	10	.12	---	---	---	842
95	21	6	40;70;95	8	7/58	40	1.2	16	600	---	843
100	30	6	52;91	30	9/76	15	.22	12	440	---	844
160	26	6	60;120	19	9/76	18	.14	18	730	---	845
225	27	6	106;210;222	22	8/60	20	.53	10	440	---	846
100	60	6	75;95	13	9/76	15	---	---	---	---	847
160	21	6	121;134,147	52	8/71	30	.28	16	640	---	848
200	46	6	52;70;140;180	49	9/76	60	38	2	100	---	849
120	42	6	73;101	31	9/76	60	.58	2	95	---	850
100	45	6	79;83	22	3/68	15	.19	11	600	---	851
97	36	6	48;96	14	9/63	40	.61	---	---	---	852
79	36	6	62;76	22	8/60	30	1.7	2	160	---	853
100	22	6	52;79	8	5/72	100	1.1	2	90	---	854
133	35	6	63;80;130	35	4/62	20	.27	---	---	---	855
281	86	6	245;271	---	8/78	30	---	---	285	---	890
240	41	6	117;190	100	10/78	5	.036	---	248	---	891
150	61	6	88;110	---	1/79	20	---	---	290	---	892
300	122	6	---	32	10/80	6	---	---	190	---	893
74	68	6	---	20	9/77	15	.44	---	160	---	894
300	102	6	225;286	---	---	5	---	5	156	6.7	895
200	61	6	---	---	---	5	---	7	233	---	896
421	138	6	143;336;377	---	---	5	---	---	---	---	897
170	27	6	82;151	38	10/78	8	.061	---	---	---	898
101	76	6	86;93	---	---	18	---	---	---	---	899
240	42	6	79;164;223	27	7/76	10	.047	---	---	---	900
141	62	6	73;95	---	---	9	---	6	220	---	901
125	102	6	112;119	38	10/80	40	---	9	303	---	902
150	82	6	95;131	50	4/79	15	---	10	368	---	903
200	40	6	180	---	---	6	---	---	---	---	904
375	61	6	76;298;349	23	10/80	10	---	---	---	---	905
220	42	6	157;201	62	10/77	6	.038	---	---	---	906
101	74	6	92;96	---	---	30	---	10	418	---	907
141	100	6	130;135	---	---	8	---	2	54	---	908
175	102	6	117;150	---	---	7	---	---	---	---	909
225	51	6	131;192	17	10/80	8	---	---	---	---	910
300	102	6	160;183	---	---	8	---	---	---	---	911
125	82	6	90;110	---	---	30	---	---	---	---	912
250	82	6	95;123;174, 225	27	7/81	10	---	2	120	---	913
161	112	6	115;121;138; 141	---	---	18	---	3	130	---	914
150	70	6	125	---	---	30	---	3	160	---	915
241	81	6	154;193;225	---	---	20	---	---	---	---	916
181	96	6	99;159;167	---	---	25	---	---	---	---	917
381	86	6	321;381	---	---	7	---	4	198	---	918
121	57	6	95;112	---	---	15	---	---	---	---	919
160	125	6	128;152	60	3/78	60	.6	---	---	---	920
175	91	6	118;163	---	---	12	---	---	152	---	921
200	41	6	56;90;160;190	32	10/78	10	.06	7	198	---	922
225	86	6	155;209	25	7/81	5	---	6	290	---	923
400	102	6	132;220;265; 310	9	7/81	8	---	4	235	---	924
150	58	6	135	14	7/81	20	---	4	195	---	925
300	82	6	98	---	---	1	---	5	228	---	926
150	105	6	112;123;131	---	---	15	---	5	210	---	927

TABLE 9

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ litholog
Number	Lat-Long							
Lb- 928	4027-7624	R. Weirbac	Myers Bros. Drilling Contractors	1979	H	540	S	Ohl/sh
929	4026-7626	P. Swope	Kohl Bros., Inc.	1977	H	500	S	Oh3/---
930	4026-7627	R. Black	Myers Bros. Drilling Contractors	1977	H	540	S	Oh3/sh
931	4027-7629	Union Salem Ch.	Kohl Bros., Inc.	1978	P	490	S	Ohl/---
932	4022-7624	H. Weise	Myers Bros. Drilling Contractors	1978	H	583	S	Oh8/sh
933	4023-7623	J. Whitmoyer	Jack M. Hatmaker	1981	H	550	S	Oh6/---
934	4024-7622	K. Grumbine	Fisher's Well Drilling	1981	H	520	S	Oh6/sh
935	4025-7621	W. Zimmerman	Gill Enterprises Inc.	1980	H	445	V	Oh6/ls
936	4026-7622	T. Zeller	Fisher's Well Drilling	1979	H	560	H	Oh2/---
937	4028-7629	Michael Hoke	Myers Bros. Drilling Contractors	1977	H	500	V	Om/sh
938	4028-7628	Russell Zellers	Kohl Bros., Inc.	1976	H	450	V	Ohl/---
939	4028-7628	Henry Arnold	Rufus A. Light	1977	H	483	V	Ohl/---
940	4024-7630	B. Barr	John Thran	1979	H	515	S	Oh4/sh
941	4023-7630	J. Krum	Myers Bros. Drilling Contractors	1980	H	465	S	Oh4/sh
942	4024-7627	W. Steiner	Richard P. Gee	1980	H	550	S	Oh6/---
943	4024-7627	Keith Gerhart	Myers Bros. Drilling Contractors	1980	H	550	S	Oh6/---
944	4024-7627	do.	do.	1980	H	550	S	Oh6/sh
945	4025-7628	L. Stamm	Fisher's Well Drilling	1980	H	485	S	Oh3/---
946	4025-7628	do.	do.	1980	H	485	S	Oh3/---
947	4025-7625	O. Pond	Myers Bros. Drilling Contractors	1978	H	525	S	Oh2/sh
948	4023-7629	O. Motter	Fisher's Well Drilling	1979	H	460	S	Oh6/ss
949	4023-7631	R. Triplett	Rufus A. Light	---	H	480	S	Oh4/sh
950	4023-7631	J. Brady	John Thran	1978	H	463	V	Oh4/sh
951	4023-7631	R. Oimond	Myers Bros. Drilling Contractors	1978	H	483	S	Oh4/sh
952	4027-7629	Carl Feeman	Fisher's Well Drilling	1979	H	948	S	Ohl/---
953	4019-7614	George Engle	Kohl Bros., Inc.	1975	H	459	V	Csc/dol
954	4024-7633	Leroy Grubb	Fisher's Well Drilling	1977	S	400	S	Oh2/ls
955	4021-7630	O. Hostetter	Myers Bros. Drilling Contractors	1978	H	460	S	Oh6/sh
956	4022-7630	Lloyd Hitz	Kohl Bros., Inc.	1976	H	485	S	Oh6/---
957	4022-7630	J. Landis	Myers Bros. Drilling Contractors	1981	H	510	S	Oh6/sh
958	4021-7631	L. Hitz	do.	1978	H	460	S	Oh4/sh
959	4020-7633	C. Long	do.	1979	H	425	S	Oh6/sh
960	4021-7633	F. Custer	John H. Mays	1981	H	508	S	Oh4/---
961	4022-7634	James Andriome	John Thran	1977	H	430	S	Oh3/sh
962	4021-7634	H. May	Fisher's Well Drilling	1980	H	500	S	Oh3/---
963	4021-7636	E. Hostetter	do.	1977	H	400	V	Ohyb/---
964	4021-7634	G. Forney	Myers Bros. Drilling Contractors	1978	H	500	S	Oh4/sh
965	4021-7634	K. Buffenmeyer	Walter Hock, Jr.	1976	H	520	S	Oh4/ls
966	4020-7631	O. Vallen	Myers Bros. Drilling Contractors	1978	H	530	S	Oh6/---
967	4019-7635	J. Jurell	do.	1978	H	670	S	Ohyb/sh
968	4019-7636	J. Risser	do.	1978	H	605	S	Ohyb/sh
969	4019-7636	Douglas Rodney	Paul T. Shiffer	1977	H	600	S	Ohyb/---
970	4020-7635	Larry Hetrick	Myers Bros. Drilling Contractors	1977	H	510	S	Ohyb/sh
971	4020-7636	O. Zartman	John Thran	1978	H	430	S	Ohyb/sh
972	4020-7636	W. Schmoyer	Myers Bros. Drilling Contractors	1977	H	420	S	Ohyb/sh
973	4019-7636	W. King	do.	1979	H	690	S	Ohyb/sh
974	4019-7636	Vic Snavely	Rufus A. Light	1978	H	618	H	Ohyb/---
975	4019-7635	B. Young	Myers Bros. Drilling Contractors	1979	H	598	H	Ohyb/sh
976	4019-7635	J. Kramer	do.	1978	H	595	H	Ohyb/sh
977	4020-7634	J. Collins	do.	1978	H	480	H	Ohyb/sh
978	4020-7634	J. Johnson	do.	1977	H	515	S	Ohyb/sh
979	4020-7634	Tony Annibali	do.	1977	H	515	S	Ohyb/sh
980	4020-7634	Adyka	do.	1977	H	518	S	Ohyb/sh
981	4019-7634	Frank Walls	do.	1978	H	525	S	Ohyb/sh
982	4019-7634	O. Conrad	do.	1979	H	500	S	Ohyb/sh
983	4020-7634	Allen Oohner	do.	1977	H	568	H	Ohyb/sh
984	4019-7635	R. Longenecker	do.	1979	H	622	H	Ohyb/sh
985	4023-7633	H. Brandt	do.	1979	H	475	S	Oh4/sh
986	4024-7634	J. D. Blatt	Fisher's Well Drilling	1977	S	380	V	Oh2/ls
987	4023-7635	M. Miller	Myers Bros. Drilling Contractors	1978	H	460	S	Oh2/sh
988	4023-7635	David Buck	Kohl Bros., Inc.	1976	H	490	H	Oh2/sh
989	4023-7634	J. Blauch	Myers Bros. Drilling Contractors	1979	H	425	H	Oh3/sh
990	4023-7634	E. Kunitake	John Thran	1977	H	405	S	Oh3/sh
991	4022-7634	C. O. Hitchcock	Myers Bros. Drilling Contractors	1978	H	415	S	Oh3/sh
992	4022-7636	B. Jenkins	Fisher's Well Drilling	1978	H	495	S	Oh3/---
993	4022-7636	O. Hazel	Myers Bros. Drilling Contractors	1978	H	465	S	Oh3/sh

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
125	82	6	89;96	---	---	15	---	---	---	---	Lb- 928
180	42	6	120;168	65	12/77	15	.13	---	---	---	929
125	95	6	100;116	---	---	40	---	---	---	---	930
160	42	6	79;131;152	44	9/78	15	.13	---	---	---	931
250	61	6	83;221	8	7/81	15	---	5	238	---	932
109	64	6	55;105	33	3/81	15	1.4	---	---	---	933
321	60	6	221;286	---	---	3	---	---	---	---	934
100	18	6	12;20;59	5	7/81	25	---	---	---	---	935
141	117	6	119;124;136	---	---	35	---	---	---	---	936
175	41	6	145	---	7/77	8	---	---	---	---	937
120	23	6	68;111	9	8/76	20	.18	6	278	---	938
74	20	6	28;60;73	10	5/77	6	.12	---	---	---	939
125	42	6	100;120	---	---	50	---	---	200	---	940
125	41	6	55;67;104	11	7/81	15	---	5	222	---	941
150	40	6	120;140	---	---	12	---	---	---	---	942
300	102	6	107;253	44	7/81	15	---	---	---	---	943
300	112	6	225;277	44	7/81	30	---	6	220	---	944
241	80	6	139;237	---	---	35	---	---	---	---	945
56	56	6	28;36;40;52	---	---	40	---	---	---	---	946
125	61	6	90;115	---	---	25	---	---	---	---	947
121	49	6	59;117	---	---	10	---	4	222	---	948
70	33	6	46;67	18	---	15	---	---	---	---	949
125	40	6	110	19	7/81	20	---	5	213	---	950
125	61	6	97;114	17	7/81	15	---	4	198	---	951
101	42	6	54;93;97	---	---	80	---	---	---	---	952
75	41	6	50;60;72	12	10/81	30	.46	17	428	---	953
120	42	6	50;103	19	7/81	25	---	13	490	---	954
175	102	6	112;126;170	---	---	20	---	---	---	---	955
100	41	6	69;77	---	5/76	20	.53	---	---	---	956
200	106	6	140;187	32	7/81	10	---	4	160	---	957
175	73	6	80;144	44	---	12	---	---	---	---	958
300	61	6	130;223	---	---	7	---	---	---	---	959
210	51	6	177	---	---	7	---	9	375	---	960
150	40	6	140	---	---	12	---	---	---	---	961
222	78	6	97;137;143; 217	---	---	15	---	3	160	---	962
301	63	6	75;290	21	7/81	4	---	4	235	---	963
150	61	6	107;143	---	---	25	---	---	---	---	964
136	28	6	60;136	20	10/76	4	.35	10	395	---	965
200	61	6	124;186	---	---	6	---	---	205	---	966
300	61	6	97	70	7/81	3	---	---	135	---	967
350	51	6	210	45	7/81	1	---	---	250	---	968
375	64	6	160;360	30	3/77	6	---	---	---	---	969
150	41	6	61;124	---	---	15	---	10	395	---	970
300	40	6	70;285	13	7/81	4	---	8	378	---	971
300	61	6	143	---	---	2	---	---	---	---	972
300	61	6	139;180;283	---	---	5	---	7	265	---	973
75	65	6	36;74	40	7/78	8	.4	---	---	---	974
200	82	6	112;180;191	---	---	12	---	---	---	---	975
125	82	6	96;105	---	---	25	---	7	235	---	976
300	31	6	90	---	---	1	---	---	---	---	977
115	41	6	67;110	25	7/81	50	---	7	290	---	978
100	41	6	73;87	18	7/81	5	---	6	218	---	979
100	41	6	65;78;90	---	---	12	---	---	---	---	980
125	41	6	94;97	15	7/81	7	---	---	---	---	981
145	61	6	70;129	---	---	6	---	---	---	---	982
300	41	6	69	---	---	.5	---	4	240	---	983
300	67	6	72	---	---	1	---	---	---	---	984
300	81	6	107;174;211; 285	---	---	7	---	---	---	---	985
401	41	6	90;381	---	---	4	---	7	468	---	986
150	102	6	112;121	---	---	15	---	10	345	---	987
120	---	6	63;104	28	4/76	20	.22	10	380	---	988
225	60	6	87	22	8/81	5	---	8	318	---	989
300	40	6	250;290	---	---	4	---	8	310	---	990
125	61	6	73;96;116	---	---	60	---	---	---	---	991
141	51	6	94;115;138	41	8/81	20	---	3	128	---	992
150	97	6	100;140	---	---	30	---	6	222	---	993

TABLE 9.

Well location		Owner	Oriller	Oate completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer/ lithology
Number	Lat-Long							
Lb- 994	4020-7630	N. Ebersole	Myers Bros. Orilling Contractors	1981	H	580	S	Oh8/sh
995	4022-7631	W. Allison	do.	1981	H	450	S	Oh4/sh
996	4023-7632	P. Strickler	do.	1981	H	480	S	Oh4/sh
997	4023-7636	B. Garman	do.	1977	H	500	H	Oh2/sh
998	4024-7628	J. Kramer	do.	1981	A	442	S	Oh6/---
999	402S-762S	G. Heist	do.	1981	H	518	S	Oh2/sh
1000	4026-7626	Gary Gingrich	Kohl Bros., Inc.	1979	H	52S	S	Oh3/sh
1001	4027-7628	Getz Constr.	Myers Bros. Orilling Contractors	1981	H	50S	S	Ohl/sh
1002	4027-7628	O. Oieffenbach	do.	1981	H	53S	S	Ohl/sh
1003	4028-7627	F. E. Hoyt	do.	1981	H	500	V	Ohl/sh
1004	4029-7627	Oonald Weigle	do.	1981	H	54S	S	Ohl/sh
100S	4023-7634	Leonard Long	Fisher's Well Orilling	1977	H	410	V	Oh3/ls
1006	4024-7631	L. E. Richard	do.	1981	H	510	S	Oh3/---
1007	402S-7630	K. Witters	Myers Bros. Orilling Contractors	1979	N	440	V	Oh3/sh
1008	4024-7630	M. Ooster	do.	1978	H	460	S	Oh2/sh
1009	4024-7636	W. Brajkovich	Fisher's Well Orilling	1981	S	482	S	Ohl/---
1010	402S-7636	O. Wissler	Myers Bros. Orilling Contractors	1980	H	502	S	Om/sh
1011	4024-7636	M. Trivigno	do.	1980	H	44S	S	Ohl/sh
1012	4023-7636	Robert Houser	Rufus A. Light	1980	H	490	S	Ohl/---
1013	4022-7637	T. Pagliaro	Myers Bros. Orilling Contractors	1980	H	48S	S	Oh3/sh
1014	4019-7636	R. Fouche	do.	1981	H	62S	H	Ohyb/sh
101S	4019-7636	do.	do.	1981	H	62S	H	Ohyb/sh
1016	4022-7633	L. Buffenmeyer	do.	1980	H	470	S	Oh4/sh
1017	4024-7634	Randy Felty	Fisher's Well Orilling	1979	H	370	V	Oh2/ls
1018	4022-763B	R. Franzone	---	---	H	4S2	S	Ohl/sh
1019	4024-7632	R. Cassel	Rufus A. Light	1980	H	50S	H	Oh3/---
1020	4026-7630	J. Litz	Fisher's Well Orilling	1979	H	442	S	Ohl/sh
1021	4028-7631	C. Varvel	Myers Bros. Orilling Contractors	1978	H	468	S	Om/sh
1022	402B-7631	W. Weikel	do.	1978	S	474	S	Om/sh
1023	402B-7631	do.	do.	1978	S	472	S	Om/sh
1024	4028-7631	do.	do.	1979	H	47S	S	Om/sh
102S	4021-7614	Richland Waterworks	---	1966	P	S4B	S	Cr/dol
1026	4020-7614	O. Newswanger	Kohl Bros., Inc.	1976	H	493	S	Cm/ls
1027	402S-7619	G. Troutman	Myers Bros. Orilling Contractors	1981	H	60S	S	Oh8/sh
102B	402S-7619	R. Triest	do.	1981	H	60S	S	Oh8/sh
1029	4023-761B	A. Boyer	Fisher's Well Orilling	1980	A	68S	S	Oh8/---
1030	4024-7620	C. Burkholder	Myers Bros. Orilling Contractors	1980	H	S7S	S	Oh8/sh
1031	4023-7621	L. Palm	Fisher's Well Orilling	1980	H	S7S	S	Oh8/---
1032	4023-7621	do.	do.	1980	A	S7S	S	Oh8/---
1033	4023-7619	A. Oaub	John H. Mays	1980	H	SSO	S	Oh8/ls
1034	4021-7618	Joseph Horning	Fisher's Well Orilling	1981	H	478	S	Ori/ls
103S	4023-7637	Margaret McCully	do.	1974	H	440	S	Ohl/---
1036	4023-7638	Floyd Tolle	do.	1981	R	462	S	Ohl/---
1037	4024-7637	East Hanover Twp.	Myers Bros. Orilling Contractors	1978	P	4SO	S	Ohl/sh
1038	4024-7630	E. Gischel	do.	1979	H	460	S	Oh2/sh
1039	4024-7630	W. Batula	Eichelberger Well Orilling	1981	H	490	S	Oh2/sh
1040	4024-7631	J. Santarelli	Myers Bros. Orilling Contractors	1978	H	SOS	S	Oh3/sh
1041	4020-7614	I. Horst	do.	1979	S	4S3	V	Cm/ls
1042	4020-7610	P. Sweigart	Fisher's Well Orilling	1981	H	640	S	Qc/---
1043	4019-7613	R. Singer	Myers Bros. Orilling Contractors	1979	H	618	S	Clv/---
1044	4019-7613	R. Bechtel	Fisher's Well Orilling	1979	H	608	S	Clv/---
104S	4020-7611	C. M. Oavid Assn.	C. S. Garber & Sons, Inc.	1980	A	SSO	S	Clv/---
1046	4020-7611	do.	do.	1980	A	SSO	S	Clv/---
1047	4020-7612	R. L. Crespo	Kohl Bros., Inc.	1976	H	S2S	S	Cr/---
1048	4019-7611	D. Oliviera	do.	1975	H	1240	S	hg/---
1049	4019-7610	June Harris	R. A. Hiner	1977	H	9SO	S	gn/---
10S0	4019-7611	Outchland Laboratory Animals Inc.	Kohl Bros., Inc.	1979	S	1210	S	hg/---
10S1	4019-7610	E. A. Harris	Fisher's Well Orilling	1977	H	9S0	S	hg/---
1052	4019-7610	1. Ulrich	Kohl Bros., Inc.	1977	H	9SS	S	hg/---
10S3	4018-7609	J. H. Levan	---	1975	H	1010	S	gn/---
10S4	4019-7630	Annville Twp. Authority	Harrisburg's Kohl Bros.	1972	P	400	V	Oe/ls
10SS	4016-7626	Quentin Water Co.	Kohl Bros., Inc.	1972	P	612	S	Cbs/---
10S6	4029-7632	Union Chapel	Fisher's Well Orilling	1980	T	618	H	Otr/---
10S7	4028-7634	H. M. Boltz	Myers Bros. Orilling Contractors	1978	H	67S	S	Ocsc/---
10S8	402B-7634	Harry Kapp	do.	1979	H	681	S	Ocsc/---
10S9	4027-763S	F. L. Custer, Jr.	Rufus A. Light	---	H	740	S	Otr/---
1060	4023-7637	Ouane Rexford	Harrisburg's Kohl Bros.	1980	S	480	S	Ohl/sh
1061	4027-7627	St. Elizabeth Ch.	Rufus A. Light	1981	T	470	S	Ohl/---
1062	4027-7626	Frederick Fulmer	Fisher's Well Orilling	1978	H	S70	S	Oh3/sh
1063	402S-7627	E. Oetweiler	Myers Bros. Orilling Contractors	1981	H	S18	S	Oh2/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Oepth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Oepth (feet)	Oiameter (inches)		Oepth below land surface (feet)	Oate measured (mo/yr)						
325	64	6	80	37	8/81	2	---	---	118	---	Lb- 994
225	43	6	107;162;212	---	---	12	---	---	---	---	995
150	82	6	93;131	---	---	45	---	---	---	---	996
200	61	6	127;195	---	---	12	---	7	267	---	997
450	128	6	130;228;383	1	8/81	7	---	---	---	---	998
225	62	6	73;112	---	---	8	---	---	---	---	999
140	26	6	87;131	46	10/79	50	.53	---	---	---	1000
100	61	6	73	---	---	20	---	---	---	---	1001
100	51	6	58;75	9	8/81	60	---	---	---	---	1002
75	54	6	56	F	8/81	30	---	8	270	---	1003
150	41	6	60	23	8/81	4	---	---	---	---	1004
120	63	6	---	---	---	15	---	---	---	---	1005
141	81	6	109;122	---	---	60	---	---	---	---	1006
150	62	6	93;129	10	---	7	---	---	155	---	1007
125	61	6	83;114	---	---	7	---	---	---	---	1008
381	53	6	70;135;192; 332	---	---	40	---	11	390	---	1009
175	101	6	112;128;134	---	---	20	---	3	81	---	1010
150	61	6	67;73;120	---	---	10	---	11	322	---	1011
86	40	6	51;86	38	8/80	5	.15	---	---	---	1012
150	82	6	90;95	45	8/81	8	---	7	198	---	1013
325	61	6	127	---	---	.5	---	6	178	---	1014
225	82	6	---	---	---	---	---	---	---	---	1015
125	41	6	50;65	17	8/81	10	---	21	495	---	1016
161	105	6	116;118	---	---	10	---	---	---	---	1017
65	---	---	---	---	---	21	---	8	240	---	1018
99	---	---	---	---	---	2	---	---	---	---	1019
141	66	6	114;133	---	---	12	---	---	---	---	1020
200	61	6	175	---	---	15	---	---	---	---	1021
100	41	6	70	---	---	60	---	---	---	---	1022
150	41	6	110;135	---	---	40	---	---	---	---	1023
150	82	6	89;123;135	---	---	15	---	5	148	---	1024
123	74	8	---	67	10/81	80	---	---	---	---	1025
385	22	6	171;377	140	2/76	10	.04	---	---	---	1026
150	61	6	68;94;109	29	8/81	12	---	---	---	---	1027
200	63	6	116;145;193	---	---	20	---	---	---	---	1028
141	40	6	100;135	---	---	15	---	---	---	---	1029
300	61	6	81;274	---	---	5	---	---	---	---	1030
160	---	6	120;128;152	---	---	18	---	---	---	---	1031
140	48	6	119;122;125	---	---	60	---	---	---	---	1032
110	40	6	47;100	25	9/80	15	---	6	---	---	1033
394	127	6	390	42	8/81	100	---	---	---	---	1034
122	42	6	83	---	---	7	---	8	290	---	1035
161	40	6	108;143	---	---	75	---	11	398	---	1036
175	82	6	125;164	---	---	20	---	10	253	---	1037
150	102	6	110	---	---	20	---	---	---	---	1038
100	43	6	71	20	5/81	12	.13	---	170	---	1039
200	123	6	130;188	---	---	20	---	---	---	---	1040
225	82	6	97;165;215	21	10/81	100	---	---	---	---	1041
144	144	6	144	---	---	60	---	---	---	---	1042
125	103	6	108;120	---	---	60	---	6	198	---	1043
158	158	6	158	---	---	12	---	1	50	---	1044
135	107	6	113	52	11/80	100	1.2	---	---	---	1045
173	156	6	158	50	11/80	100	.81	---	---	---	1046
116	80	6	102	8	9/81	12	.13	6	202	---	1047
137	50	6	58;74;113	10	11/75	25	.20	1	68	---	1048
120	42	6	68;111	4	9/81	12	.10	2	52	---	1049
140	68	6	82	12	3/79	20	.16	---	---	---	1050
501	63	6	190;440	---	---	1	---	4	135	---	1051
180	43	6	86	38	6/77	5	.04	---	---	---	1052
---	---	6	---	---	---	10	---	1	61	---	1053
130	40	12	55;112	2	7/72	688	---	---	---	---	1054
360	101	10	99;163;210	80	8/72	146	1.6	---	---	---	1055
161	82	6	109;121	---	---	8	---	---	---	---	1056
275	82	6	156;160	---	---	45	---	2	58	---	1057
250	82	6	165	---	---	3	---	---	---	---	1058
206	29	6	58;205	---	---	7	---	4	122	---	1059
280	40	6	260;275	30	8/80	20	.08	---	---	---	1060
55	42	6	30;54	25	5/81	12	---	---	---	---	1061
101	73	6	79;87;94	---	---	60	---	---	---	---	1062
100	83	6	87;94	19	9/81	60	---	---	226	---	1063

TABLE 9

Well location		Owner	Driller	Date completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer/ litholog
Number	Lat-Long							
Lb-1064	4025-7627	David Gray	Kohl Bros., Inc.	1976	H	419	V	Oh3/sh
1065	4026-7629	F. Sebastian	Fisher's Well Drilling	1977	H	440	V	Oh3/sh
1066	4025-7630	S. Oaub	Myers Bros. Drilling Contractors	1979	H	481	S	Oh3/---
1067	4021-7637	S. Gingrich	do.	1977	H	362	V	Ohyb/---
1068	4031-7631	Clair Wagner	Fisher's Well Drilling	1977	H	648	S	Ocsc/---
1069	4031-7629	Warren Kessler	do.	1977	H	620	S	Otr/---
1070	4031-7630	George Gundrum	do.	1977	H	625	S	Ocsc/---
1071	4027-7623	Marlin Reifein	Myers Bros. Drilling Contractors	1981	H	511	S	Oh3/sh
1072	4026-7624	A. Kunkle	Gill Enterprises Inc.	1980	H	515	S	Oh2/ls
1073	4024-7626	J. Wida	Myers Bros. Drilling Contractors	1980	H	590	H	Oh6/ss
1074	4024-7626	J. Light	do.	1980	H	603	H	Oh6/---
1075	4024-7629	J. Copenhaver	Gill Enterprises Inc.	1980	H	425	V	Oh2/ls
1076	4024-7629	J. Bayler	Myers Bros. Drilling Contractors	1981	H	453	S	Oh2/sh
1077	4024-7626	E. Fields	do.	1981	H	621	H	Oh6/---
1078	4024-7626	B. Clark	Fisher's Well Drilling	1973	H	595	H	Oh6/---
1079	4024-7626	do.	do.	1981	A	595	H	Oh6/---
10B0	4029-7632	Swatara St. Pk.	Kohl Bros., Inc.	1978	W	482	V	Otr/---
10B1	4026-7621	B. Stoyer	Fisher's Well Drilling	1980	H	445	V	Oh2/ls
1082	4024-7621	R. A. Sponhower	Kohl Bros., Inc.	1979	H	461	S	Oh8/sh
10B3	4023-7621	Fisher's Well Drilling	Fisher's Well Drilling	1980	A	425	V	Oh8/---
1084	4024-7617	R. Shenk	do.	1981	A	650	S	Oh8/---
10B5	4021-7614	L. Bennetch	Myers Bros. Drilling Contractors	1979	H	459	S	Cr/---
1086	4021-7613	J. Firestine	do.	1981	H	420	V	Cr/dol
1087	401B-7622	Alcoa	---	---	N	534	S	Cbs/ls
1088	401B-7623	do.	---	---	N	528	S	Cbs/ls
10B9	401B-7623	do.	---	1966	N	513	S	Csc/ls
1090	4017-7622	do.	Kohl Bros., Inc.	1976	N	611	S	Cbs/ls
1091	4020-7610	Eagles Peak Campground	Fisher's Well Drilling	1981	C	1110	H	hg/---
1092	4014-7631	Pa. Game Comm.	Eichelberger Well Drilling	1981	T	541	S	Trhss/---
1093	4027-7627	Dutch Country Egg Farms	Myers Bros. Drilling Contractors	1980	S	508	S	Oh1/sh
1094	4027-7627	do.	do.	1980	S	536	S	Oh3/sh
1095	4027-7627	do.	do.	1980	H	536	S	Oh3/sh
1096	4017-7613	G. Diefenderfer	do.	1978	H	698	S	Trhss/sh
1097	4017-7623	Gill Enterprises Inc.	Gill Enterprises Inc.	1978	N	603	S	Cbs/ls
1098	4017-7623	do.	do.	1979	N	605	S	Cbs/---
1099	4022-7638	Seamans Market	Myers Bros. Drilling Contractors	1979	N	490	S	Oh1/ls
1100	4020-7617	Eastern Lebanon Co. Sch.	Fisher's Well Drilling	1981	T	509	S	Os/ls
1101	4026-7626	Pennfield Corp.	---	---	N	455	V	Oh2/ls
1102	4018-7630	Stoney Crest Estates	---	---	P	561	S	Cm/ls
1103	4018-7630	do.	---	---	P	559	S	Cm/ls
1104	4021-7627	West Lebanon Water Co.	---	---	P	561	S	Oh8/sh
1105	4020-7627	do.	---	1939	P	520	S	Oh8/sh
1106	4017-7617	Heidelberg Twp. Munic. Authority	Gill Enterprises Inc.	1981	P	610	V	Trhss/---
1107	4023-7620	Myerstown Water Authority	Kohl Bros., Inc.	1967	P	528	V	Oh8/ls
1108	4021-7625	Leon Zimmerman	Myers Bros. Drilling Contractors	1965	P	670	S	Oh8/---
1109	4021-7625	do.	do.	1965	P	670	S	Oh8/---
1110	4021-7625	do.	do.	1977	P	670	S	Oh8/---
1111	4020-7624	Bethlehem Steel Co.	Kohl Bros., Inc.	1965	N	483	V	Oe/ls
1112	4020-7624	do.	do.	1965	N	483	V	Oe/ls
1113	4026-7626	C. F. Manbeck, Inc.	do.	1968	N	470	C	Oh2/---

(CONTINUED)

Total depth below land surface feet)	Casing		Oepth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Oiameter (inches)		Oepth below land surface (feet)	Oate measured (mo/yr)						
116	36	6	54;72;105	15	9/81	60	.59	12	405	7.2	Lb-1064
121	63	6	108;115	---	---	20	---	6	172	---	1065
150	41	6	49;67;140	---	---	20	---	---	---	---	1066
120	61	6	93;113	18	9/81	20	---	5	260	---	1067
301	63	6	105;287	---	---	6	---	---	---	---	1068
201	84	6	92;188	---	---	25	---	2	85	---	1069
141	42	6	115;134	---	---	20	---	---	---	---	1070
150	82	6	102;119	16	9/81	25	---	---	---	---	1071
180	58	6	82;133;165	30	11/80	10	---	---	---	---	1072
175	61	6	123;157	---	---	12	---	---	---	---	1073
200	74	6	86;190	41	9/81	50	---	5	162	---	1074
160	25	6	58;99;147	14	8/80	40	---	---	---	---	1075
125	73	6	86	---	---	30	---	---	---	---	1076
250	63	6	93;114;237	---	---	5	---	---	---	---	1077
122	60	6	61;116	---	---	30	---	5	150	---	1078
321	62	6	117;318	---	---	60	---	---	---	---	1079
178	44	6	77;110;150	32	10/78	10	.07	2	67	---	1080
81	40	6	60;75;78	---	---	15	---	---	---	---	1081
180	41	6	75;92;148	48	7/79	15	---	---	---	---	1082
141	40	6	25;70;90;138	---	---	20	---	---	---	---	1083
240	50	6	58;182	---	---	8	---	---	---	---	1084
200	123	6	135;170	---	---	20	---	---	---	---	1085
400	42	6	118	---	---	.5	---	---	---	---	1086
288	71	14	123;142;166	42	10/81	800	---	---	---	---	1087
300	50	14	83;96	29	10/81	500	---	---	---	---	1088
200	85	13	131;163;174; 192	43	10/81	500	---	---	---	---	1089
215	82	6	---	80	10/81	4	.12	---	---	---	1090
640	60	6	184	---	---	3	---	---	---	---	1091
200	30	6	152;181	---	---	4	---	---	---	---	1092
250	61	6	66;215	---	---	12	---	---	---	---	1093
300	61	6	94;100;248	---	---	20	---	---	---	---	1094
300	61	6	67;243;278	---	---	20	---	---	---	---	1095
250	102	6	136;175;240	---	---	20	---	4	100	---	1096
140	120	6	132	55	7/78	70	---	---	---	---	1097
342	82	6	90;120;320	80	10/81	45	---	---	---	---	1098
250	82	---	210;235	---	---	8	---	---	---	---	1099
400	184	6	242;264;338	46	10/81	20	---	---	---	---	1100
130	39	10	60;110;121	32	3/75	500	35	---	---	---	1101
505	53	6	---	---	---	16	---	---	---	---	1102
500	---	6	---	---	---	15	---	---	---	---	1103
140	---	---	---	74	10/81	30	---	---	---	---	1104
417	139	6	---	---	---	70	---	---	---	---	1105
138	52	8	84;101;130	---	---	150	---	---	---	---	1106
205	117	16	143;168;191	3	9/67	350	12	---	---	---	1107
302	63	6	---	53	10/65	15	1.5	---	---	---	1108
322	63	6	---	52	10/65	12	1.5	---	---	---	1109
600	102	6	215;271;340; 390	---	---	50	---	---	---	---	1110
96	---	20	26;40;72	14	3/69	1800	---	---	---	---	1111
180	---	---	40;70;90	15	3/69	600	---	---	---	---	1112
200	79	6	---	33	5/82	400	---	---	---	---	1113

TABLE 10. RECORD OF SPRINGS

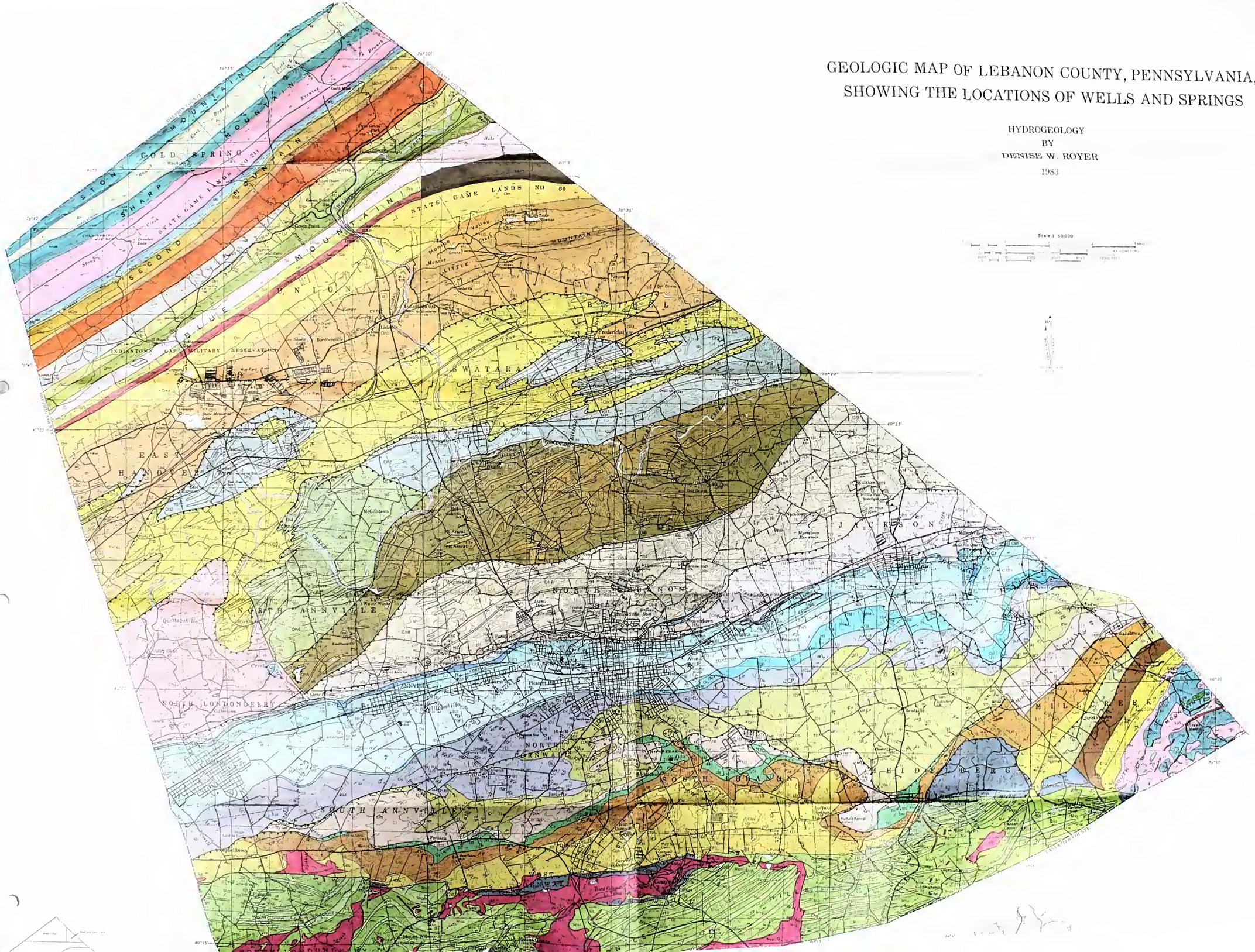
Number	Lat-Long	Owner (Spring name)	Altitude above sea level (feet)	Aquifer	Estimated discharge (gal/min)	Date estimated	Use[1]	Temperature (°C)	Remarks
Lb-Sp- 1	40°16'43" 76°29'19"	Satterson	485	Snitz Creek Formation	---	---	S	10.6	---
Sp- 2	40°16'43" 76°29'15"	do.	477	do.	---	---	D,S	10.6	---
Sp- 4	40°17'00" 76°27'39"	Mays Kurtz	505	do.	10	7-2-57	D,S	11.7	---
Sp- 5	40°16'56" 76°27'34"	Howard Patches	507	do.	---	---	D,S	11.7	---
Sp- 6	40°16'31" 76°27'22"	Levi H. Mumma	520	Buffalo Springs Formation	---	---	D,S	12.1	---
Sp- 7	40°17'12" 76°25'42"	Erwin Auman	510	do.	<10	---	U	12.0	Chemical analys available
Sp- 8	40°16'36" 76°28'55"	Harold Risser	500	Snitz Creek Formation	75	7-30-57	D,S	11.7	---
Sp- 9	40°16'34" 76°29'00"	do.	490	Buffalo Springs Formation	---	---	D,S	12.2	---
Sp-10	40°16'09" 76°28'58"	Stanley Meyer	540	Diabase Buffalo Springs Formation	<10	7-30-57	D	13.3	---
Sp-13	40°19'56" 76°28'14"	John Long	420	Epler Formation	---	---	D	11.7	---
Sp-14	40°19'57" 76°28'12"	do.	418	do.	---	---	U	11.7	---
Sp-18	40°19'48" 76°29'45"	Annville Water Co. (Penrythe Spring)	410	do.	1000	7-11-61	P	11.0	Chemical analys available
Sp-S2	40°19'24" 76°15'51"	Abraham Zimmerman	500	Snitz Creek Formation	100	7-30-57	D,S	11.4	---
Sp-S3	40°17'28" 76°20'17"	Daniel Backenstose	515	Buffalo Springs Formation	---	---	U	12.2	---
Sp-S4	40°17'05" 76°19'04"	M. Gichner	490	Snitz Creek Formation	50	7-26-57	D,S	---	---
Sp-S5	40°16'49" 76°21'56"	Mark Heisey	620	Buffalo Springs Formation	---	---	---	---	---
Sp-S6	40°16'50" 76°21'13"	Wayne Patches	600	do.	5	8-20-57	D,S	14.4	---
Sp-S8	40°22'16" 76°17'47"	Miles Hauer	440	Annville Formation	10	8-22-57	---	10.6	---
Sp-S9	40°23'02" 76°19'04"	Henry Brubaker	510	Hershey Formation	3-5	8-23-57	D	11.0	Chemical analys available
Sp-60	40°21'52" 76°22'15"	Ella Kurtz	538	do.	5	8-23-57	D,S	11.4	---
Sp-61	40°20'34" 76°30'43"	Annville Water Co. (Steinmetz Spring)	550	Hamburg sequence rocks	30	5-22-81	P	---	---
Sp-62	40°20'38" 76°30'10"	Annville Water Co. (Meyer Spring)	495	do.	50	5-22-81	P	---	---
Sp-63	40°22'23" 76°30'36"	John Landis	500	do.	---	---	I	13.0	Chemical analys available
Sp-64	40°17'43" 76°17'39"	(Schaefferstown Spring)	600	Hammer Creek Formation	---	---	P	15.0	do.
Sp-65	40°20'35" 76°24'16"	Bethlehem Steel Co.	484	Epler Formation	500+	5-7-82	N	13.0	---

[1]Use: D, domestic; I, irrigation; N, industrial; P, public supply; S, stock; U, unused.

GEOLOGIC MAP OF LEBANON COUNTY, PENNSYLVANIA, SHOWING THE LOCATIONS OF WELLS AND SPRINGS

HYDROGEOLOGY
BY
DENISE W. ROYER

1983



EXPLANATION

SYMBOLS

Contact

Faults

TRIASSIC

DIABASE

Medium to coarse-grained dark gray rock, massive hard, weathers gray or light buff

HAMMER CREEK FORMATION

Fine to coarse-grained, red, brown, and gray sandstone, langlomerate composed of white vein quartz and red siltstone pebbles in a red sandstone matrix, and langlomerate composed of bluish limestone and finely crystalline marble pebbles in a red to gray sandstone matrix

NEW OXFORD FORMATION

Red to purplish red shale, sandstone, and mudstone interspersed with beds of light-colored micaceous sandstone, arkose, and conglomerate

PENNSYLVANIAN

LLEWELLYN FORMATION

Gray, fine- to coarse grained sandstone, siltstone, shale, conglomerate, and numerous anthracite coals in repetitive sequences

POTTSVILLE GROUP

Gray conglomerate, fine to coarse grained sandstone, siltstone, and shale, contains minable anthracite coals

MISSISSIPPIAN

MAUCH CHUNK FORMATION

Interbedded grayish red sandstone, siltstone, and shale

POCONO FORMATION

Light gray to buff, medium grained, crossbedded sandstone and some interbedded siltstone, commonly conglomeratic at base and in middle

SPECHTY KOPF FORMATION

Light to olive gray, crossbedded sandstone and fine to medium grained siltstone

UPPER DEVONIAN

CATSKILL FORMATION

Succession of grayish red sandstone, siltstone, claystone, and minor conglomerate, generally in fining-upward cycles

Water is generally soft, occasionally high in iron, and in quantities adequate for domestic supply.

TRIMMERS ROCK FORMATION

Olive gray siltstone and shale, characterized by graded bedding

Median yield of domestic wells is 9 gal/min. Water is soft, has a low pH value, and is thus potentially corrosive to metal plumbing.

MIDDLE DEVONIAN

MAHANTANGO FORMATION

Gray, brown, and olive shale and siltstone

Too few data are available to evaluate the water-bearing properties of this rock unit. The hardness of water from one well is 17 mg/l.

LOWER SILURIAN

SHAWANGUNK, ROSE HILL, AND TUSCARORA FORMATIONS

Light- to dark gray, fine- to very coarse grained sandstone and conglomerate containing shale interbeds (Ss), olive-gray, fossiliferous shale that weathers pale yellowish brown (Srh), and white to gray orthoquartzite and minor interbedded shale, locally conglomeratic at the base (St).

Not tapped by wells

HAMBURG SEQUENCE

(These lithotectonic units are in probable order of emplacement, and may be in reverse order of age.)

UPPER CAMBRIAN(?) TO UPPER ORDOVICIAN

YELLOW BREECHES THRUST PLATE

[Emplacement before, during, or after the Hamburg sequence]

Dark gray shale (sh) with minor interbeds of argillaceous sandstone (as), red shale (rs) and limestone (ls)

LITHOTECTONIC UNIT 8

Olive-weathering gray shale (sh) and brick-red shale (rs) with minor beds of fine-grained brown argillaceous sandstone (as), quartzitic sandstone (ss), and limestone (ls)

LITHOTECTONIC UNIT 6

Greenish brown siltstone and argillaceous sandstone (as) and shale (sh), with interbeds of maroon shale (rs), sandstone (ss), and limestone (ls). Igneous rocks present are metadiabase (md) and andesite extrusives (ae).

Median yield of domestic wells is 12 gal/min. Median nondomestic yield in Berks County is 110 gal/min. Very low yields are obtained from igneous and metamorphic rocks.

LITHOTECTONIC UNIT 4

Black and orange-weathering laminated shale (sh), quartzite (as), and thin- to medium-bedded sandy limestone (ls)

Median yield of domestic wells is 15 gal/min. Median nondomestic yield in Berks County is 62 gal/min.

LITHOTECTONIC UNIT 3

Interbedded red siltstone and shale (rs), olive siltstone and shale (sh), siliceous shale (as), and minor beds of chert (ch) and quartzitic sandstone (ss)

Median yield of domestic wells is 20 gal/min. Median yield of nondomestic wells is 58 gal/min

LITHOTECTONIC UNIT 2

Interbedded limestone (ls) and micaceous shale and siltstone (sh), massively bedded calcarenite often associated with limestone. Limestone conglomerate (cg) and red shale (rs) are also present in minor amounts.

Median yield of domestic wells is 15 gal/min. Nondomestic yields reported for two wells were 400 and 500 gal/min.

LITHOTECTONIC UNIT 1

Olive-weathering gray shale (sh) and graywacke (as).

Median yield of domestic wells is 15 gal/min. Median yield of nondomestic wells is 17.5 gal/min.

HAMBURG SEQUENCE ROCKS, UNDIFFERENTIATED

Gray, dark gray, and greenish gray phyllitic shale and silty argillite.

Too few data are available to evaluate the water bearing properties of this rock unit.

LEBANON VALLEY SEQUENCE

MARTINSBURG FORMATION

Gray to dark gray, buff-weathering shale.

Median yield of domestic wells is 17.5 gal/min. Median water hardness is 68 mg/l.

LEBANON VALLEY SEQUENCE (cont.)

MIDDLE ORDOVICIAN

ANNVILLE FORMATION

Light-gray, finely crystalline, thick-bedded, high-calcium limestone

Not an important aquifer because of small areal extent and thinness. Median yield of domestic wells is 30 gal/min. Water is very hard.

BEEKMANTOWN GROUP

ONTELAUNEE FORMATION

Medium- to dark-gray, thick-bedded, crystalline dolomite.

Highly permeable aquifer. Median yield of domestic wells is 11 gal/min. Median yield of nondomestic wells is 200 gal/min. Aquifer is capable of yielding adequate quantities to meet industrial and municipal needs. Very hard water.

LOWER ORDOVICIAN

EPLER FORMATION

Interbedded medium-gray limestone and dolomite, cherty; numerous beds of calcarenite

Permeability is typically low, except near contact with Stonehenge Formation (Os). Median yield for domestic wells is 11 gal/min. Median yield for nondomestic wells is 205 gal/min. Aquifer is capable of yielding adequate quantities to meet industrial and municipal needs. Water is very hard

RICKENBACH FORMATION

Gray cherty dolomite, finely crystalline

Median yield for domestic wells is 18 gal/min. Water is very hard

STONEHENGE FORMATION

Medium-gray crystalline limestone; cherty in upper part; limestone conglomerate is present near base.

Typically highly permeable, but permeability is reduced near contact with Richland Formation (Єr). Median yield for nondomestic wells is 20 gal/min. Water is very hard

UPPER CAMBRIAN

CONOCOCHEAGUE GROUP

RICHLAND FORMATION

Gray, thick bedded, finely crystalline dolomite; limestone, chert, and calcarenite interbeds. Limestone is most abundant in middle of formation.

Typically poorly permeable, but more permeable near contact with Millbach Formation (Єm). Median yield of domestic wells is 11 gal/min. Water is very hard

MILLBACH AND SCHAEFFERSTOWN FORMATIONS

Pinkish-gray to light-gray, laminated, crystalline limestone with algal structures (Єm), and light- to medium-gray, finely crystalline limestone containing minor beds of calcarenite (Єs).

Highly permeable aquifer. Median yield of domestic wells is 40 gal/min. Capable of yielding adequate quantities to meet industrial and municipal needs. Very hard water

MIDDLE CAMBRIAN

SNITZ CREEK FORMATION

Light- to medium gray, coarsely crystalline oolitic cherty dolomite.

Poorly permeable aquifer. Median yield [illegible] is 6 gal/min. Water is very hard

BUFFALO SPRINGS FORMATION

Light- to pinkish gray limestone interbedded with light-gray dolomite, crystalline.

Moderately permeable aquifer; less permeable near contact with Triassic rocks. Median yield for domestic wells is 10 gal/min. Median yield for nondomestic wells is 82 gal/min. Aquifer is capable of yielding adequate quantities to meet industrial and municipal needs. Water is very hard

LEHIGH VALLEY SEQUENCE

LEITHSVILLE FORMATION

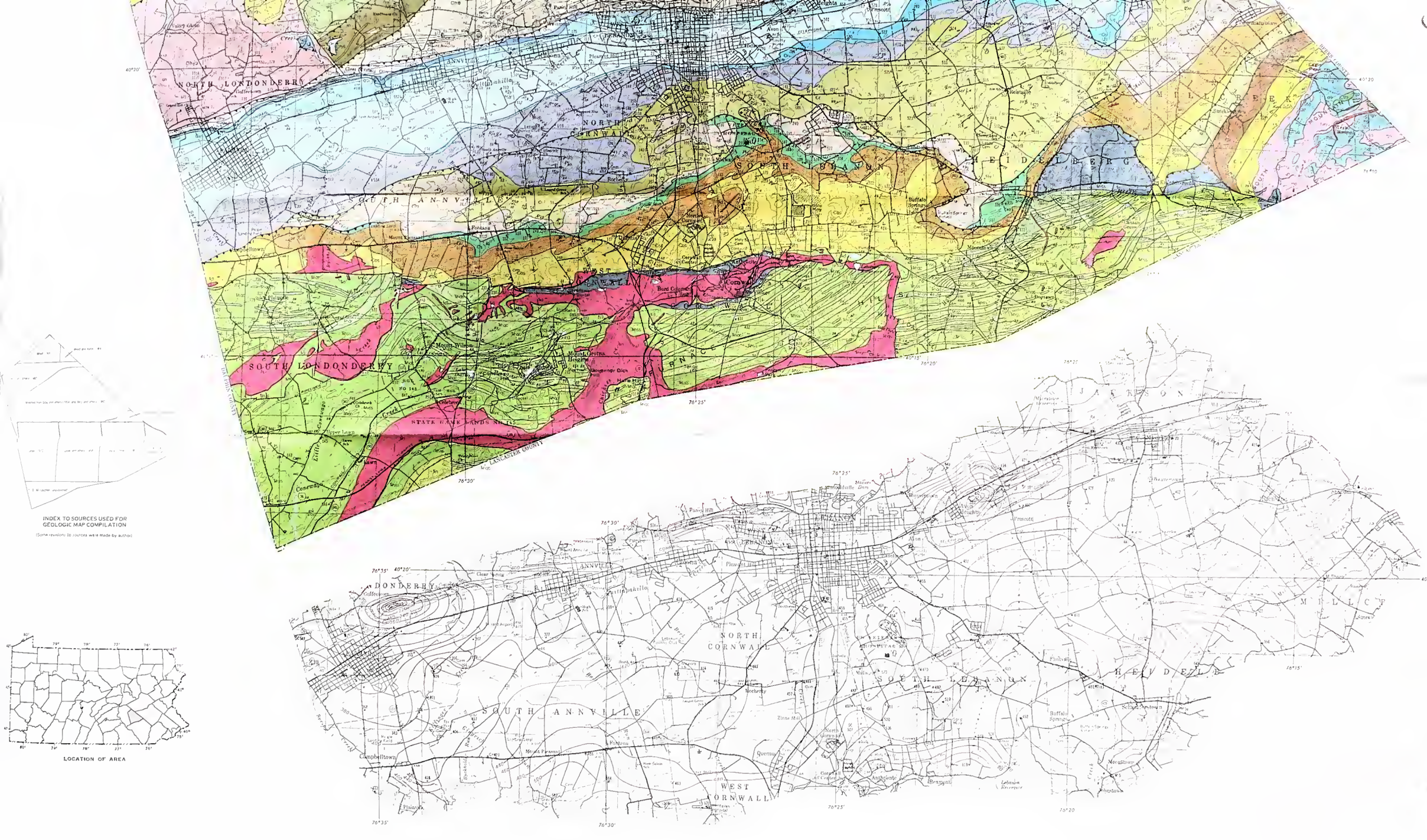
Medium- to dark gray, crystalline dolomite, shaly in upper part, considerable chert in lower part

Moderately permeable aquifer. Median yield [illegible] domestic wells is 100 gal/min. Water [illegible]

LOWER CAMBRIAN

HARDYSTON FORMATION

Light-gray quartzite and feldspathic sandstone, conglomerate at base



MAP SHOWING WATER-LEVEL CONTOURS IN THE LEBANON VALLEY IN OCTOBER 1981

Water well from which water was sampled for chemical analyses and county well number

Spring and county spring number

Spring from which water was sampled for chemical analyses, and county spring number

PLANATION

er level contour

Spring

Quarry

ershed divide

UPPER DEVONIAN

MIDDLE DEVONIAN

LOWER DEVONIAN

UPPER SILURIAN

LOWER SILURIAN

UPPER ORDOVICIAN

MIDDLE CAMBRIAN

LOWER CAMBRIAN

PRECAMBRIAN

Mdsk

SPECHTY KOPF FORMATION

Light- to olive-gray, crossbedded sandstone and fine- to medium-grained siltstone

Dcd Dcl Dsc Dev

CATSKILL FORMATION

Succession of grayish-red sandstone, siltstone, claystone, and minor conglomerate, generally in fining-upward cycles

Dtr

TRIMMERS ROCK FORMATION

Olive-gray siltstone and shale, characterized by graded bedding

Dmh

MAHANTANGO FORMATION

Gray, brown, and olive shale and siltstone.

Too few data are available to evaluate the water-bearing properties of this rock unit. The hardness of water from one well is 17 mg/l.

DSbl

ONONDAGA FORMATION THROUGH FOXONO ISLAND FORMATION, UNDIVIDED

Gray calcareous sandstone and shale interbedded with limestone and dolomite.

Sb

BLOOMSBURG FORMATION

Grayish-red siltstone, shale, and sandstone arranged in fining-upward cycles.

Ch2

LITHOTECTONIC UNIT 2

Interbedded limestone (ls) and micaceous shale and siltstone (sh); massively bedded calcarenite often associated with limestone. Limestone conglomerate (cg) and red shale (rs) are also present in minor amounts.

Median yield of domestic wells is 16 gal/min. Nondomestic yields reported for two wells were 100 and 500 gal/min

Oh1

LITHOTECTONIC UNIT 1

Olive-weathering gray shale (sh) and graywacke (as).

Median yield of domestic wells is 15 gal/min. Median yield of nondomestic wells is 17.5 gal/min.

Oh

HAMBURG SEQUENCE ROCKS, UNDIFFERENTIATED

Gray, dark-gray, and greenish-gray phyllite shale and silty argillite.

Too few data are available to evaluate the water-bearing properties of this rock unit.

LEBANON VALLEY SEQUENCE

Om

MARTINSBURG FORMATION

Gray to dark gray, buff-weathering shale

Median yield of domestic wells is 17.5 gal/min. Median water hardness is 68 mg/l.

OHy

HERSHEY FORMATION

Dark-gray argillaceous limestone.

Poorly permeable aquifer. Median yield of domestic wells is 22 gal/min. Very hard water

Omy

MYERSTOWN FORMATION

Gray, crystalline, thin-bedded limestone, graphite at base

Too few data are available to evaluate the water-bearing properties of this rock unit. Median yield of one domestic well in Berks County is 20 gal/min. Very hard water

Cbp

SNITZ CREEK FORMATION

Light- to medium-gray, coarsely crystalline, oolitic, cherty dolomite.

Poorly permeable aquifer. Median yield for domestic wells is 6.0 gal/min. Water is very hard

Cbs

BUFFALO SPRINGS FORMATION

Light- to pinkish-gray limestone interbedded with light-gray dolomite, crystalline

Moderately permeable aquifer, less permeable where in contact with fine-grained rocks. Median yield for domestic wells is 10 gal/min. Median yield for nondomestic wells is 25 gal/min. Aquifer is capable of yielding adequate quantities to meet industrial and municipal needs. Water is very hard.

LEHIGH VALLEY SEQUENCE

Cv

LEITHSVILLE FORMATION

Medium- to dark-gray, crystalline dolomite, shaly in upper part; considerable chert in lower part

Moderately permeable aquifer. Median yield for nondomestic wells is 140 gal/min. Water is moderately hard

Chs

HARDYSTON FORMATION

Light-gray quartzite and feldspathic sandstone, conglomeratic at base

Too few data are available to evaluate the water-bearing properties of this rock unit. Median yield for domestic wells is 15 gal/min.

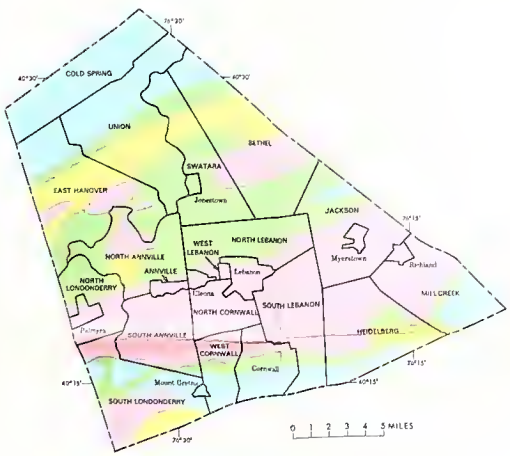
SOUTH MOUNTAIN

gn pg hg mg

METAMORPHIC ROCKS

Metadiabase (md), granite gneiss (gn), hornblende gneiss (hg), and graphitic gneiss (gg).

Yields small supplies of water that are commonly adequate for domestic use. Many wells tapping these rocks are unable to meet consumptive use requirements. The water is soft, but it is high in iron and may need to undergo treatment before use.



MAP SHOWING HARDNESS OF GROUNDWATER

EXPLANATION

HARDNESS OF WATER, IN MILLIGRAMS PER LITER

60 or less soft

61 120 moderately hard

121 180 hard

More than 180 very hard

Colors are generalized, a few wells yield water that is softer or harder than the color range on the map indicates

1 milligram per liter = 1 part per million = 0.058 grain

Base map from U.S. Geological Survey Lebanon County 1:50 000 topographic map

Geology compiled by Denise W. Roser 1981 82, based on sources listed on Index to Sources Used for the Eight Map Compilations

Hydrogeology by Denise W. Roser 1981 82

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John A. Kochanski Cartographer